EDITORIAL

I FEEL I should make some comment about the screen size of TV sets currently available on the Australian market.

I have no desire to interfere with the right of any set manufacturer to sell any size screen he thinks fit. Throughout the world these vary at the moment from 9-inch midgets to 27-inch mammoths, and each has its own function and place in the scheme of things.

And that's the whole point of my remarks.

Before TV sets were officially on the market, most Australian set manufacturers had decided to mmence operations with a 17-inch screen, and this is the e now being offered in all brands except one.

No doubt they had their reasons for this policy.

But when reading some of the advertising and publicity aterial which has appeared, I feel sure that many prospec-e buyers have gained the impression that this size is some id of optimum or standard ideal for our conditions.

I do not agree with such a view.

In my opinion, the 21-inch screen has proved the most pular overseas for the type of home and general use most mmonly found in Australia.

In England, where there are only 405 lines, and where many people live in homes with small rooms, the 17-inch een is very popular. In America, where the lines are 525, 21-inch screen is favored by the vast majority. Every or TV set now made has a 21-inch screen.

For a 625 line system such as used in Australia and the ntinent, a 24-inch screen is perfectly practicable.

I would venture an opinion that, before very long, most the Australian manufacturers will have 21-inch sets for e, and their reasoning will be very similar to that I have t given.

Naturally the 17-inch set has its rightful place when a dest picture is acceptable. But I am quite convinced that ny set buyers will be disappointed and even disillusioned en eventually 21-inch sets become more generally avail-e, on the grounds that they were encouraged to believe t a larger screen wasn't worth the difference.

TV has already suffered in the public mind by squabbles, ra taxes, and the tendency in some quarters to regard as a new field from which to extract unjustified gain.

Don't let us add to the confusion perpetuating the idea against weight of growing world opin-that the 17-inch screen is the t word.

John Moyle

INDEX

on For Banking	3	About Ferroresonant Circuits	57
ectronic Totalisator	4	A Reader Built It	63
ight Amplifiers Work	9	The 1956 Car Receiver	64
tion's Helical Aerial	13	The Serviceman Who Tells	75
Control With TV	15	Let's Buy An Argument	80
Will You Strike Oil?	16	Trade Notes And News	85
orised Portable	21	Book Reviews	88
Single-Gun TV Tube	23	Here's Your Answer, Tom!	94
Without Power Unit	27	Australian TV Standards	96
And Views	29	Off The Record	102
Supply For Portables	32	Short Wave Notes	112
Baffling Problems	37	The Ham Bands	113
rse In Television	48	Answers To Correspondents	124

RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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THIS MONTH'S COVER

Dr. Calvin Konzak, associate geneticist at the Brookhaven National Laboratory, shows Chuck Dallyn some rust-resistant oats produced from irradiated seeds. By such methods modern scientists are playing a vital part in the world's food production.

Palec

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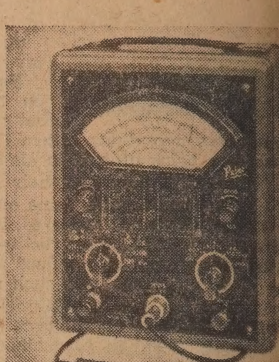

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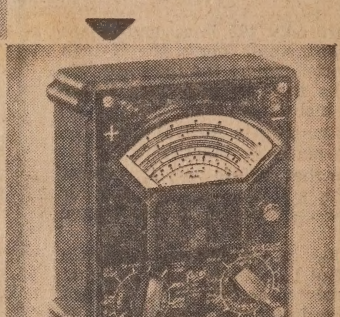

MODEL MX32. Thirty-two range.
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Current: AC 0-1 mA (for use with ext. C.T.).
Voltage: AC and DC to 1000 Volts.
Resistance: 0-10 Megohm (Int. Battery)
Decibels, etc.
MODEL M32. Thirty-two range.
Radio and Electrical Multimeter:—1000 O.P.V. Ranges as MX32.

Model TV-M Vacuum Tube Vo meter.
This instrument is a basic neces Television Service.
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MODEL M42. Forty-two range. General Purpose Multimeter:—1,000 O.P.V.
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M32	Multimeter	£1
M42	Multimeter	£3
M52	Multimeter	£4

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TELEVISION INVADES BANKING

Late innovation for bank clerks in the United States is the use of television. Installed at the Mechanics and Farmers Savings Bank at Brideport, Connecticut by the Mosler Safe Co., it allows a customer to bank his money from a roadside kiosk large enough for a motorist to remain seated in his car. The kiosk contains a TV camera, monitor tube and two-way speaker system. Transactions are carried out by means of pneumatic tubes to the teller, located some hundred feet away. Photo shows: Top—A motorist gets a televised view of the bank teller and is able to make his deposit via a TV Snorkel built and installed in a Roadside Banking Unit. Bottom—The bank teller entering a notation in the pass book—on the screen is a view of the customer in the roadside banking kiosk some distance away.

A battery of readers installed in vehicle to form a transportable "tote"

THE ELECTRONIC TOTALISATO

It is not generally realised that the Totalisator was invented by an Australian, the late S George Julius, who designed, made and installed the world's first Totalisator at Ellerslie (Ne Zealand) in 1913. Since then, the Australian firm of Automatic Totalisators Limited, founde by Sir George, has made installations throughout the world, including England, France, Sou Africa, India, Malaya, North and South America. Here is an authoritative article describi the engineering behind this ingenious equipment.

by

D. C. Harvie

"TOTALISATOR BETTING" is based on what is called the "Pari-Mutuel" system, that is, the dividends paid to the successful investors are a re-distribution of the money contributed by all the investors in a particular race.

Each race betting period begins with an empty money pool and finishes with the total amount contributed by all investors on that race. From this, a percentage is deducted for the race club and government taxation, and the remainder distributed to the successful investors.

The deduction, which reduces the "gross" pool to the "nett" pool, varies according to local government regulations.

The most common local betting "pools" are win and place. These are represented by two separate totalisators on the one mechanical framework. In the case of the win pool, the (nett) total investment is divided equally among all the successful winning investors.

In the place pool it is divided among all the successful place investors, but since three "horses" are successful in the place pool, the pool is divide three equal parts, each third being divided equally among the (plac vestors on that particular horse.

NUMEROUS POOLS

There are numerous other typ pools, but for the purposes of th lowing description, we will co only the win and the more co "doubles" pool with say 20 runn each race.

The basic principles of these apply to all other pools.

In straight out "win" betting machine requirements are simple

Each horse or runner is allot separate adding machine. The issuing machines are designed so the operator may select any one of 20 adders and, by directing an in to that adder, place one or more bets on the particular horse.

Usually, each ticket issuing ma sends out one impulse for each i ment, whether it be a single uni 5/-) or a multiple unit (say £1)

MECHANICAL FEATURES

The adders are designed so when they receive an impulse fro 5/- issuer, one count is registered when an impulse is received from issuer, through either mechanic electrical multiplying, four count registered.

It is obvious, therefore, that f runners there must be 20 signal from each issuer, one to each The adding units are electrically nected to a grand total adder is of almost identical design t other adders. Since it is in series each of the horse adders, it must r and count all impulses on all add

The ticket issuers are connect the adding machines through a distributor. In its simplest form distributor is merely a constantly ing selector. The rotating arm the central power supply, and the (approx. 20) studs around th phery, each one connects to a s issuer.

This distributor rotates at ap mately one rev. per second ar sures that no two ticket issuer operate at any one time, thus s

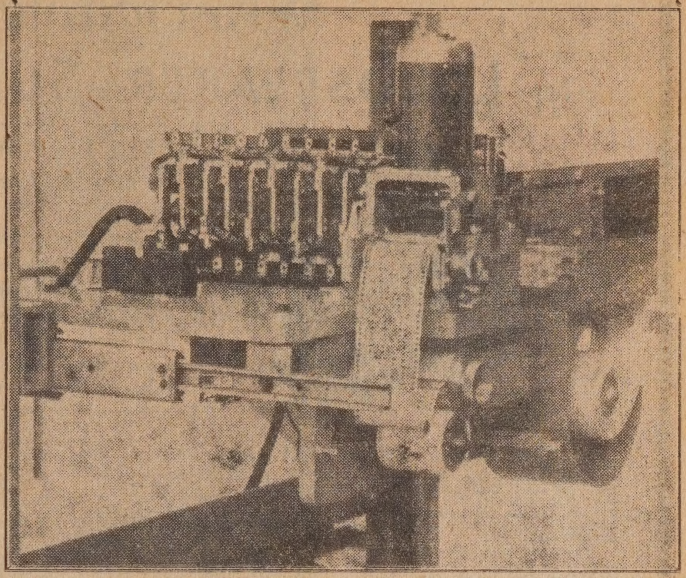
he bets or impulses going to the
s into (20) per second.
ere, as in most cases, more than
suers are required, the whole sys-
or "bank" described above is dupli-

this case, the adders are divided
nternally by means of a differen-
gear system to accommodate as
banks as necessary.
ere are various types of adders
distributors, but they all follow
ame basic principles.
ne adders use mechanical differ-
s, electro-mechanical relays, or
one stepping switches.
ner types of distributors consist
elay chains either continuously
g. or on the "first come first serv-
principle.
ket issuers, although of many dif-
types, are all basically identical,
re designed so as to issue a ticket
e investor and, at the same time,
r an impulse to the adders. There
nany complex interlocking systems
are designed to ensure that the
given to the investor is repre-
ive of the "horse" adder to which
npulse is directed.

JE" DOUBLES

e "true" doubles totalisator presents
more difficult problem than the
e win tote.
ereas only 20 adders (plus a grand
adder) are required for a win
20 times 20, that is, 400 adders,
equired for a doubles pool.
ce these adding units are com-
devices with most elaborate inter-
ig systems, the cost of 400 is far
id most practical applications.
mpromise methods are often used.
simplest is the manual system,
in pre-printed tickets are sold from
k or reel, each ticket carrying a
number as well as the horse selec-
At the end of the selling period,

CLOSE-UP OF THE RECORDER UNIT



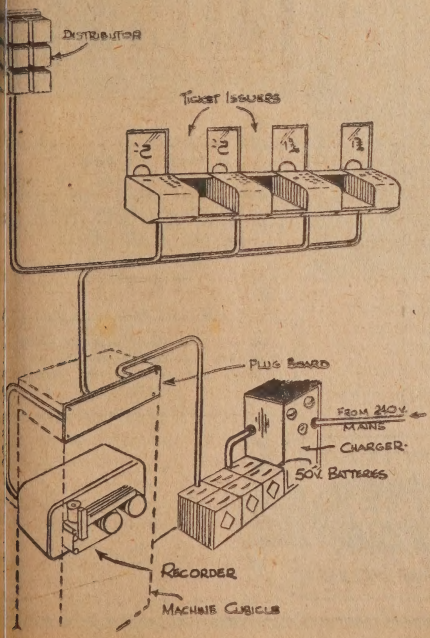
A close-up of the recorder unit pulled out from its frame. The "swords" and operating relays behind them are clearly seen, together with the tape transporter . . . and its punch.

the remaining serial numbers are read, and the total number of tickets sold is calculated. This method is cumbersome and expensive in its day to day operation, due to the large number of operators required.

A second method is the "reinvestment doubles" system, whereby only 20 adding units are provided and tickets sold for the "first leg" horse only. This system, although simple and reliable, is not a "true" double.

After a "first leg" horse has won, the successful investors return to the windows and "reinvest on a second leg horse".

The original 20 adding machines have in the meantime been set to zero and are used again for the second leg. This second leg addition is, of course, essential to arrive at the correct subdivision of the pool for the finally successful investors.



This diagram shows the interconnection between the ticket issuing and bet-recording system.

It has long been recognised that both the foregoing are cumbersome and not entirely suitable for the majority of betting applications. Race clubs and totalisator manufacturers throughout the world have long been searching for a satisfactory alternative, but with little success due to expense, slowness or inaccuracy.

Electronics appeared to provide the solution but experience overseas showed that the "electronic" tote could not handle accurately such large amounts of money without some positive checking system.

In electronic calculators, the answer is usually known to a fairly close degree before the problem is put to the machine, so that, in fact, an error in a decimal point would be most obvious when the answer was delivered. Also, the machines are operated by highly trained personnel, who are constantly aware of the inherent problems of the machine.

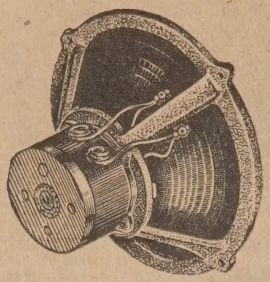
ASTRONOMICAL ERROR

This is not so with the totalisator, where, if a payout of £10 is made instead of £1, the error is multiplied by the number of investors, so that the loss could be astronomical. Such a loss is unfortunately undetectable until the pool is prematurely used up. By this time it is too late for the error to be corrected, and the excessive dividend must be paid until all successful investors are satisfied.

In any race where there are (say) 400 combinations, it is obvious that only one can win, and that therefore only one adding machine (plus a grand total) is fundamentally necessary. Unfortunately, we don't know until after

Wharfedale

for LOUDSPEAKER SUPREMACY



"The First Wide Range Speaker to sound like True Music . . . ."
(Statement made by leading professional musicians.)

Comparative Listening Tests have proved the Supremacy of Wharfedale Speakers for Absolutely Natural Reproduction. That is why the world's leading manufacturers of high quality amplifiers and pickups (incl. American) recommend Wharfedale Speakers: they do fullest justice to their product.

The Super 12"/CS/AL Speaker

Illustrated above, is fitted with aluminium voice coil, special cone with bakelised apex, and radial corrugations, plus the undoubted advantage of cloth suspension. This assembly, with the extremely high flux density, results in excellent transient response and sensitivity with a very wide frequency range. Since the introduction of this model some years ago, the world-wide demand has always exceeded the supply.

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Specifications: Alcomax III Magnet; Flux density 17,000 lines on 1¾in centre pole; Total Flux 190,000 lines.

We also recommend the following models:

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A new and highly efficient treble unit for use at frequencies above 3,000 c/s on FM transmissions and wide range record reproduction. Frequency response: 3,000c/s—20,000c/s.

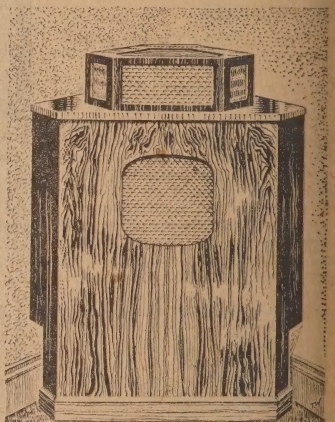
SUPER 8" CS
For refined quality up to 4 watts, or for use as Middle or Treble Speaker with cross-over network.

SUPER 8" CS/AL
An outstanding Treble Unit with aluminium speech coil and response maintained up to 20,000 c/s. This model is recommended for use in twin-speaker systems.

WHARFEDALE 10" CSB
After the Super 12"/CS/AL the 10"/CSB, fitted with wide-response cone and aluminium dome, is the best single speaker in the Wharfedale range.

WHARFEDALE 12"/CS
The 12"/CS makes a very good bass unit with suitable reflex loading and a cross-over between 400 and 3,000 c/s, and is the "next best" to the Wharfedale 15"/CS.

WHARFEDALE 15"/CS
Now generally recognised as the best low frequency unit so far produced in England or any other country! This speaker is designed for smooth response between 25 and 2,000 c/s, with heavy cone and long speech coil. It is the ideal speaker for cross-over networks. When provided with 8 or 9 cubic feet of air loading the cone resonance is below 25 c/s.



Sand-filled Corner Enclosure as recommended by Messrs. Wharfedale.
Illustration shows unit in use with middle and high frequency speakers facing upwards. (N.B. This unit also recommended as the ultimate for the Super 12" CS/AL speaker and twin speaker systems.)

The cloth suspension, employed in all Wharfedale Speakers, lowers the bass resonance and gives a very smooth "top".

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MF 8211 **Simon Gray** PTY. LTD. MF 8166
RADIO DIVISION
28 ELIZABETH STREET MELBOURNE C1

ce is run which one this is.
problem has been solved in Aus-
designed equipment by first
all bets on a punched tape until
nner or winning combination was
It was then simply a matter
acting the winning combinations
he tape and adding them on one
machine.

n the punched tape, electronic
was the obvious answer.
possible errors in the electronic
could now be readily picked
running the tape through twice,
ter still, by using two adders
lem. Since both these adders are
independent, the answers will
heck on each other. In the event
fault in either adder, the tape
run through again in a few
s, or in an extreme case, the
can be delayed until the mach-
repaired, since the error is obvi-
fore the dividend is declared.

problem evolved itself into two
defined sections: (1) storing the
n some form of tape, and (2)
the stored bets at the appropri-
e.

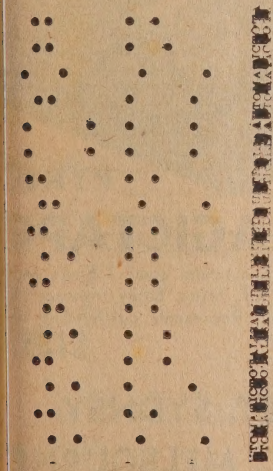
ING THE BETS

ain well tried methods are pos-
Magnetic tape, printed tape, or
d tape were among the most
s mediums to use.

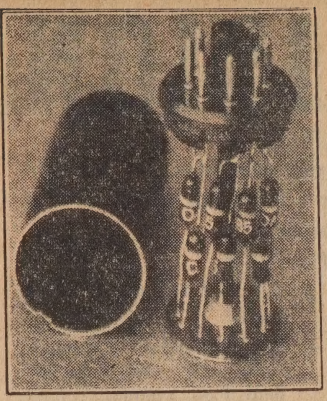
netic tape was discarded because
in the supply or magnetic cir-
uld lose all records of the trans-
If the tape was placed near
trong magnetic field, they would
ed off.

telegraph punched tape system
scarded because a varying num-
punched holes were required
ch different signal. If, for ex-
"A" horse was represented by
le, "B" by two holes and "C"
ee holes, in the event of one
breaking down, B would be-
, creating a hidden error which,
talisator, spells catastrophe.

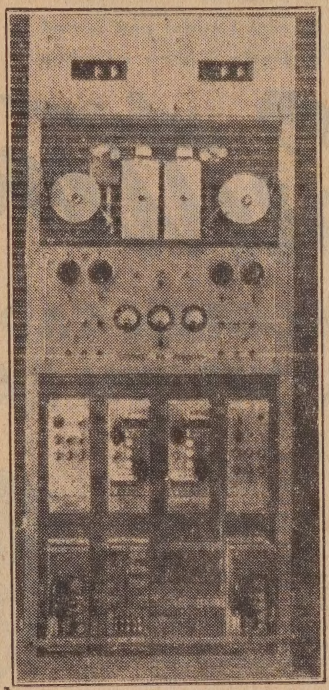
eight-channel system was ulti-
selected from which channels



ce of the perforated tape used.
ed sprocket perforations are pre-
punched.



The coincidence gate built of germanium diodes mounted on an octal base.



These show the dual reader. On top can be seen the two counting units, lower down is the mechanical section showing the tape running from one reel to another over the dual reading heads. This mechanism is merely an enlarged version of a magnetic tape recorder and except for the reading heads, works in a similar way. This whole mechanical unit slides out of the rack for servicing.

In the middle of the unit can be seen the control panel with the two sets of selector switches. On the left are the first and second leg selectors for the left hand reader. On the right ditto for the right hand reader.

Switches to control the movement of the tape either right or left can be seen. At the bottom of the control panel are jacks for testing the various circuits, and a rotary selector switch to arrange the circuits in a suitable manner for testing.

The racks on the bottom contain the power packs and the coincidence mixers &c. all in duplicate.

It is interesting to note that the results of the complete race can be read on this machine in about 15 seconds, representing a single pass of one full roll containing all bets. The tape passes over the heads at a speed of 44in per second, while the counter records at a speed of 320 impulses per second. This is well within its maximum limit which is 12,000 per second.

can be paired to give 28 possible combinations. The circuit was then designed so that if more or less than two punches operated, the machine would stop, indicate the code that was trying to get through, and the ticket issuer from which the signal was coming.

Since the device must register double bets, 16 channels are necessary, four punches operating for each bet.

The punched tape is 2 3-8in wide with 1-16in diameter holes, and is stepped approximately 1-8in along its length for each bet.

With the tape established, the rest of the design was comparatively straightforward. The ticket issuing machines (known as TIMS for short) were already established in principle although an ingenious device was added to select the appropriate signal wires.

WIRE SELECTION

In each TIM were two telephone type stepping switches having three separate levels. When, by means of a push button on the issuer one contact representing the selected horse in (say) the first leg in the top level was energised, the switch stepped around to that position. The remaining two levels in that switch then sent out the code signal corresponding to the appropriate two punches in the punched tape machine or "recorder".

At the same time, these two stepping switches (one for each leg) rotated printing drums to an appropriate position to allow the correct ticket to be printed.

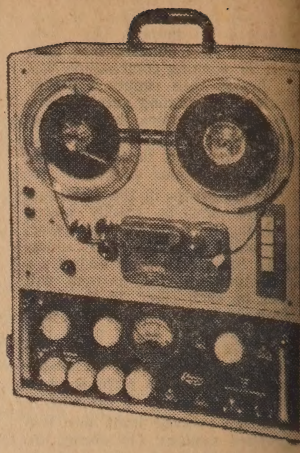
The recorder is a device roughly similar to a teletype machine. A heavy duty punching solenoid operates in every betting position. If, however, no code has been sent out, this solenoid cannot operate the printing punches, since the hammer bar alone is not long enough to hit their heads. When a code is sent, solenoids push interference bars known as "swords" between the solenoid and the punches, their extra thickness in the gap allowing the punches to penetrate the paper.

Various interlocking devices ensure that the appropriate number of punches operate and that the paper is fed forward after each bet. If the paper feed

(Continued on Page 119)

ROTAVISION

Mark II



This most versatile of tape recorders is chosen by music and radio personalities for its brilliant sound reproduction.

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- ★ Two headphone monitoring channels
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- ★ 12in. replay speaker in separate case
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- ★ D.B. Meter recording level
- ★ Hi-fi amplifier — detachable for 12 watt independent P.A. System
- ★ Two speeds, twin track, 3 motors
- ★ Fast forward and rewind
- ★ Up to 3 hours recording

. . . see it at

Suttons

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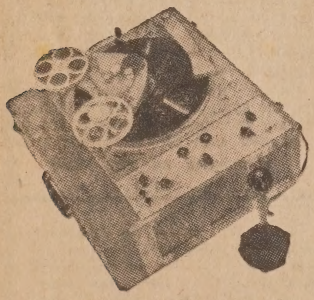
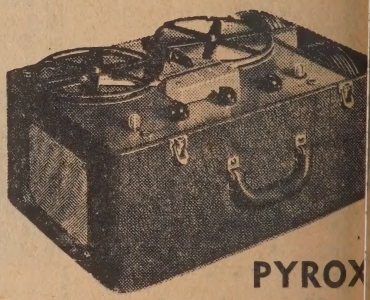


TD1

Tape & Disc

RECORDER

Make Standard or Mirco-groove discs, record from tape to disc or vice versa on this playing and recording unit. An in-built oval speaker enables this machine to be used as a public address system also.



PYROX

ELCON RADIOCORDER

A 7-valve machine, incorporating Tape recorder, 6-valve radio and P.A. System all in the one cabinet. Twin-speed, dual-track recording.

£155/10/-

MAGICTAPE

This dual-track machine gives 3 hours contin recording on L.P. tapes. Easily transportable most efficient. Represents outstanding valu

£135/1

Suttons PTY. LTD. (Inc. in Vic)

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105 ELIZABETH ST, MELBOURNE

HOW LIGHT AMPLIFIERS WORK

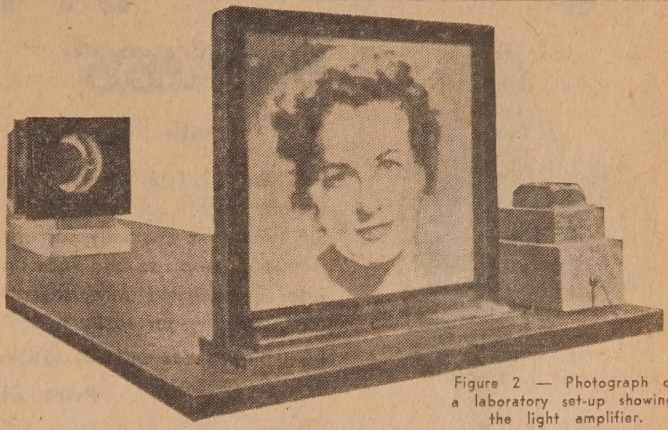


Figure 2 — Photograph of a laboratory set-up showing the light amplifier.

A device for the amplification of light is one of the most important electronic developments at the RCA Research centre at Princeton, USA. This article describes the equipment shown to me during my recent visit to the laboratories—Editor.

RHAPS one of the reasons for the reater confusion in the understand- f light amplifiers than that experi- with electrical amplifiers is that ord LIGHT has a number of con- ons.

m the physical point of view light cified by giving the radiant power atts per unit wave-lengths as a l distribution and within the wave- region of 4000 to 7000 Ang- s. This specifies the stimulus to the eye is sensitive.

m the psychophysical point of view is described in terms of luminance ured in lumens), dominant wave- s and purity, which take into nt the eye characteristics and are itatiyely measurable.

NCEPTIONS OF LIGHT

m the psychological point of view is described in terms of brightness, nd saturation which are descriptive sensations of light and are not y measurable, but correspond iably well to luminance, dominant length and purity.

these concepts of light are used enerally, are the cause of consider- onfusion. To add to this, light has extended to include "black" light, is, the radiation in regions of the um outside the visible range, such ultra-violet and infra-red.

the purposes of this discussion will be considered as radiant power ed by a spectral distribution giving per unit wave-length. The device n the amplification of light is thus ially a power amplifier.

equires (1) an input consisting of a f light or a picture, (2) an output, consisting of another spot of light ture, and (3) a source of power supplies the larger amount of required in order that the output ater than the input.

an electrical amplifier the input, and power source are all elec- In the amplifier of light the input utput are light, but the power is electrical. It is, therefore, ary that the input light control the sion into light of the larger amount of power supplied by the power source.

As a result there are the following two requirements of such an amplifier of light: (1) a method of converting electrical energy into light and (2) a method of controlling, by means of light, the amount of energy converted.

There are many ways of converting electrical energy into light. Of these, two will be mentioned. (1) Is cathodo-luminescence whereby power of an electron beam on striking a phosphor is converted into light; (2) is electro-luminescence whereby the power of an AC or DC source on application to a suitable phosphor is converted into light.

The amount of electrical energy converted into output light using these methods may be controlled by the input light level with the aid of materials which are photo-sensitive.

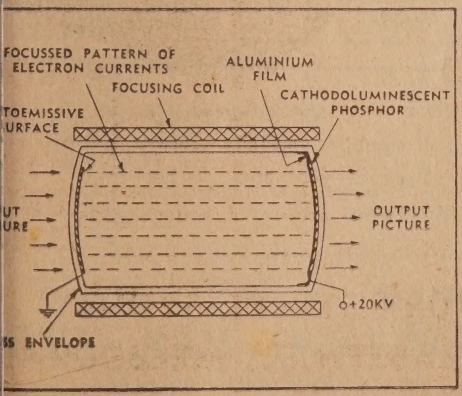
An older type of light amplifier which demonstrated these basic principles is shown schematically in Fig. 1.

This device operates as follows: The input light controls the number of electrons emitted by the photo-emissive surface. These electrons are then accelerated to a high velocity by the 20-kV power supply.

ELECTRON VELOCITY

The amount of electrical energy converted into light by the phosphor is determined by the number of high velocity electrons striking it. The output light is thus controlled by the input light incident upon the photo-emissive surface.

If the efficiency of the photosurface is adequately high and if a sufficiently high voltage power supply is used, the output light is greater than the input and a gain greater than unity is obtained.



re 1 — Representation of an early type of light amplifier.

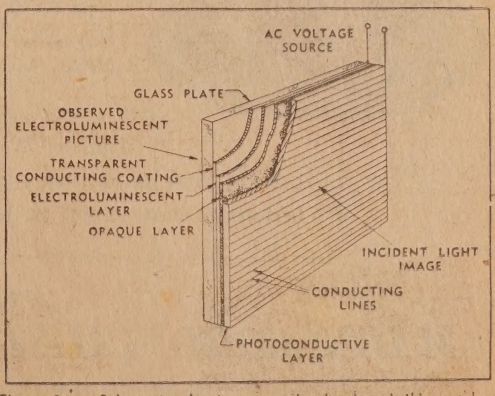


Figure 3 — Schematic showing a newly developed thin-panel light amplifier.

WORLD'S FINEST

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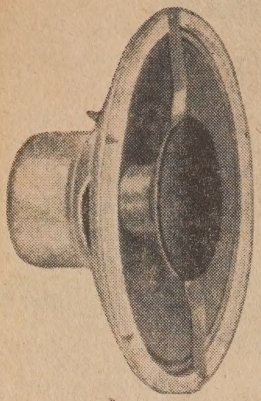

Peerless Coaxial 12in Speaker with 5in. Tweeter for High-Fidelity

Providing high sensitivity, low nonlinear distortion and excep tionally smooth response over the whole frequency range. Th 5in tweeter is coaxially suspended and provides excellent hig frequency response and wide angle distribution. The high-pas filter is concealed under the pot cover and an extra tag yield the possibility for easily added HF-control.

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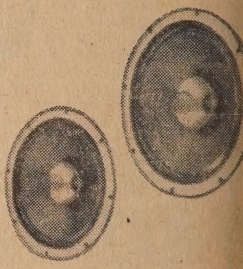
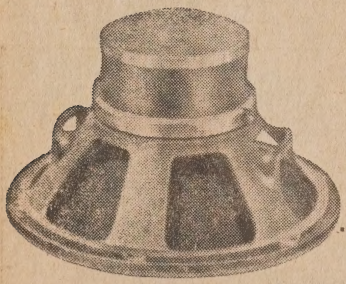


(Far right:) 12in Dual Cone Speaker with frequency range from 45-14,000 cycles. Design provides High-Fidelity reproduction at moderate cost with velvet smoothness over the entire range.

Input Impedance optional 15 Ohms or 5 Ohms. Price £8.5.0.

(Right:) 8in High-Fidelity Dual Cone with frequency response flat 55-16,000 cycles. This is one of the most versatile Loudspeakers in the world and is now in wide use in multiple Loudspeaker systems and small cabinet enclosures throughout Europe and America.

Input Impedance optional 15 Ohms or 5 Ohms. Price £5.18.6.



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Peerless High Fidelity Loudspeakers are available at all well equipped resellers. However, if there is no such supply source in your area, do not hesitate to write direct to the Distributors.

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aluminium film on top of the
or is transparent to electrons, but
to light and serves to prevent
rative feedback of output light
e input.

form of light amplifier has many
al limitations, among which are:
requirement of high vacuum,
limitation in size, and (3) the
or a high voltage power supply.

her type of amplifier which does
ave the previously mentioned
ons has been developed and can
de in the form of a thin panel
size. Fig. 3 shows schematically
panel amplifier of light.

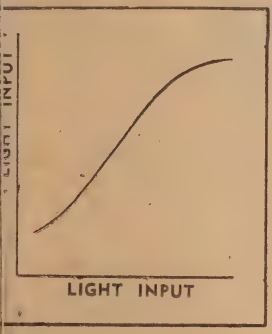
O-CONDUCTIVE SHEET

seen that besides the electro-
scent sheet which converts the AC
al power into light, there is a
onductive sheet, which by con-
the amount of light, incident
, determines the amount of elec-
power converted into light. In
n, there is included a sheet which
que to light in order to prevent
k of light from output to input.
feedback, if excessive, would
tely prevent the reproduction of
ne pictures.

principle of operation of this am-
will be presented with the aid
4. Fig. 4a represents a single
of the amplifier. Fig. 4b gives
uivalent circuit of the amplifier
t. The variable resistor corres-
to the photoconductor and the
or to the "EL" (Electrolumi-
) phosphor.

opaque sheet having neglibible im-
e is not included.

light output from the phosphor



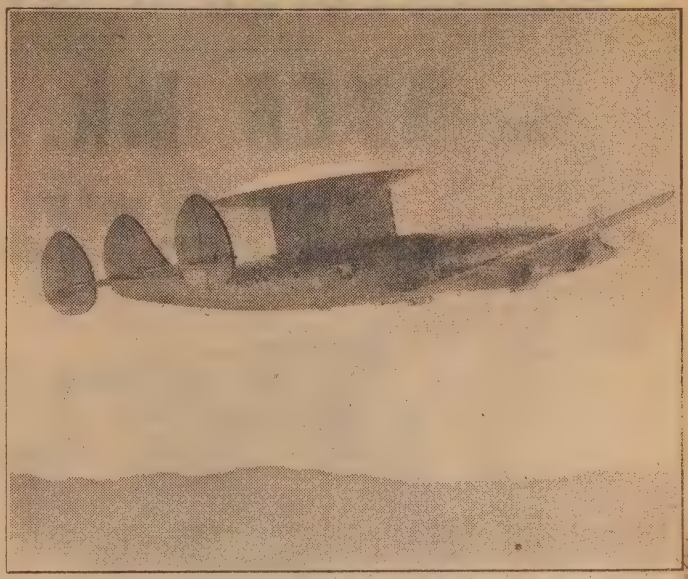
5 — Gain is a function of light imprint.

es rapidly with the voltage across
own in Fig. 4c. The conductivity
photoconductor varies with the
ight, approximately, as shown in
4d.

he operation of the amplifier, a
ternating voltage is applied across
otoconductor (R) and "EL" phos-
). In the dark, the resistance of
otoconductor is very high and only
small fraction of the applied AC
will appear across C and "EL"
or will essentially not emit any

ere is light incident on the photo-
tor, the resistance R is reduced
appreciable fraction of the ap-
oltage appears across C and the
hosphor emits light.

A FLYING SAUCER IS AIRBORNE

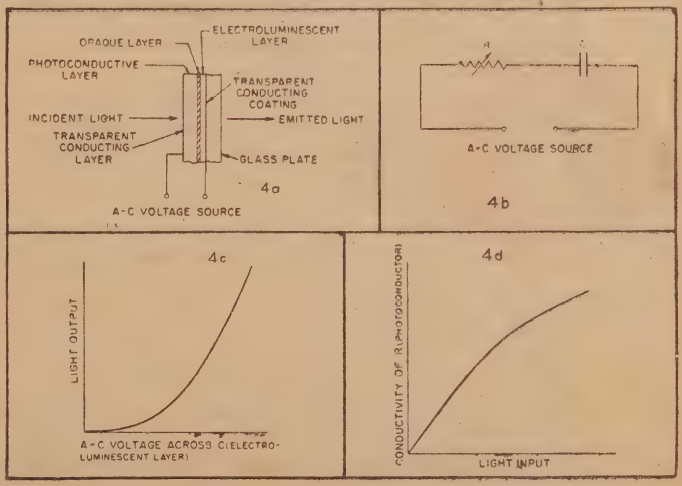


FLYING SAUCER AIRBORNE — The new radar "early warning" version of the Supe. Constellation which Lockheed Aircraft Corporation has developed for the U.S. Navy is now undergoing intensive flight testing at Edwards Air Force Base, U.S.A. Its "flying saucer" ellipsoid, measuring 30 feet across, houses secret electronic equipment that will enable the plane to scan an even larger area. The WV-2 radar Super Constellation now on duty with the Navy flying at 10,000 feet can direct its radar beams over a surface of approximately 45,000 nautical miles. Lockheed test pilots Herman (Fish) Salmon and Roy Wimmer report that the disc does not jeopardize stability or control.

The spectral, decay and transfer characteristics of a light amplifier correspond in a general way to the frequency, delay and transfer characteristics of an electrical amplifier. There are, however, significant differences.

Whereas, within the pass band of the electrical amplifier, the output is similar to the input, or, at least, has a fundamental component of identical frequency in the output and input, this need not be

(Continued on Page 123)



Figures 4a, b, c and d. Diagrams and curves illustrating the principles of operation of the light amplifier. Figures 4a and 4b give circuit representations, and Figures 4c and d are curves showing light output and conductivity characteristics.

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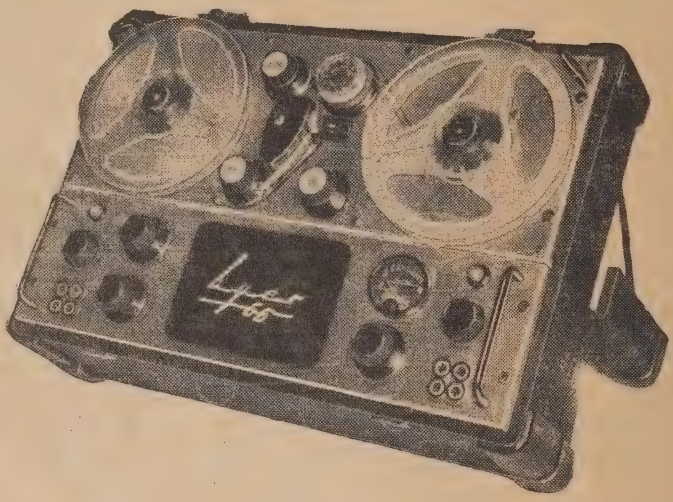

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TV STATION'S HELICAL AERIAL

During the past few months, the citizens of Sydney have watched two tall TV masts grow from the high ground on the North side of Sydney Harbor. These belong to ATN and TCN, the two commercial stations, one of which has already transmitted test programs. They carry the aerial arrays which, for efficiency, must be as high as possible above the surrounding terrain.

TCN'S antenna is particularly interesting. It was designed and prefabricated in Holland by Philips, while the 500ft tower on which the antenna is now mounted, was pre-fabricated in Australia. The mast itself is not the radiator of energy. It merely serves to elevate the radiator to a height to obtain the greatest posible radius of television coverage.

The antenna consists of a series of four cylindrical spirals (helices). These are wound around a steel cylinder which carries the insulators, which in turn support the helices.

The helix, in its simplest form, is usually designed for VHF communication systems, the diameter chosen so that the length per turn is equal to the wavelength radiated. Such an "end fire" helix, with its axis horizontally placed, radiates circularly polarised waves.

SIDE-FIRE PATTERN

When the helix circumference is made two or more wavelengths, the radiation maximum is in a direction perpendicular to the helix axis. This is termed "side-fire" operation and is ideally suited to television systems requiring horizontal polarization, and equal radiation intensity in all horizontal directions (ie, with the helix axis vertical instead of horizontal).

Since the radiation intensity is rapidly reduced at angles away from the horizontal, little energy is radiated in unwanted directions, ie, vertical. Hence, the "effective radiated power" (ERP) of the antenna is far greater than the power actually fed to the antenna. With the TCN antenna this gain factor is 12.

The TV stations licensed in the capital cities in this country are to have an ERP of 100kW. With a gain of 12, 10kW maximum output is sufficient to supply the required ERP as well as to compensate for the loss in the transmitter system.

The same gain is of course obtained from the sound transmitter which feeds 1/10th of power to the same antenna, producing an ERP of 20kW.

MECHANICAL CONSIDERATIONS:

In designing the antenna proper and its tower, the effect of gale winds was a major consideration. The usual design figure envisages wind speeds of 120 mph.

This picture shows the lightning arrester and warning lamp being lifted to the top of the antenna. The construction of the Helix Side Fire antenna is clearly seen.

MAINTENANCE

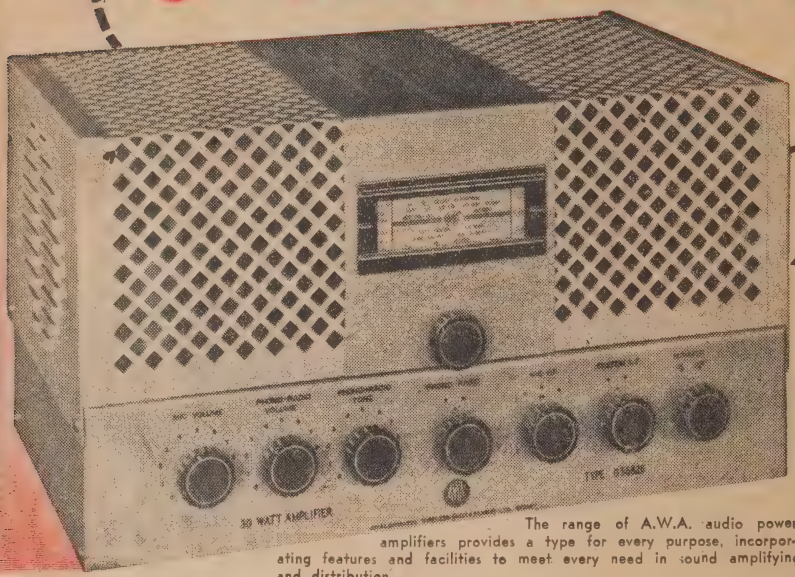
For maintenance purposes, access is required inside of the steel cylinder only. All adjustments, such as replacements of the insulators and similar fittings can be made from within the pipe. A winch-driven platform or lift is installed inside the cylinder for conveyance of personnel and equipment.

A hinged lid over the top of the antenna keeps out rain, and a lightning ring, greater in diameter than the helix, is fitted to the main cylinder, which in turn is securely bonded to the tower steel work. A flashing beacon is mounted inside the lightning ring as a warning to aircraft. Power cables are installed within the steel pipe.

In locations where ice is encountered, the antenna can be de-iced simply and effectively by passing mains supply AC through the helix wires. The antenna is protected against lightning, as the central steel cylinder is earthed to the tower, and the helix itself is grounded at the extremities. The physical arrangement offers ease of mounting and the low wind loading shows a direct saving in tower costs.

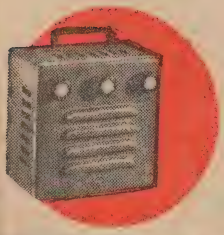
PUBLIC ADDRESS AMPLIFIERS

5 Watt to 70 watt

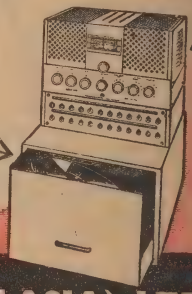


The range of A.W.A. audio power amplifiers provides a type for every purpose, incorporating features and facilities to meet every need in sound amplifying and distribution.

Designed and built to the same high standards of quality workmanship and performance for which the Company has established a world-wide reputation in broadcasting and communication equipment, models PA825 15 watt, PA826 30 watt and PA827 70 watt are illustrated above with radio tuner PA831 fitted. The amplifier protective cover has provision for mounting a monitor speaker.



5 watt portable amplifier type PA806 provides ample power for the needs of most indoor gatherings and many outdoor applications.



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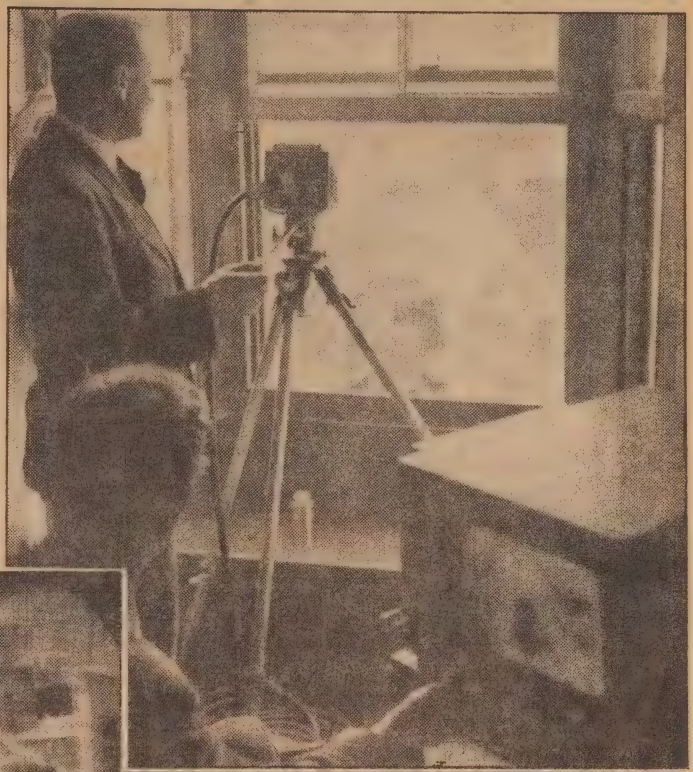
BIG BROTHER IS WATCHING

ndustry is finding new uses for elevision monitors, which can eep a watchful eye on pro- esses and events, relaying the icture they see back to a suit- ble control point. As with adar, monitors are now being ressed to service in traffic bservation, helping to clear he roads more quickly and to detect breaches of the law.

hese pictures show an experimental llation in Durham, England, where Pye Co. supplied equipment to the police force.

o the town's market place traffic oaches via two bridges, both of h are outside the range of vision he traffic constable, whose job it clear it. Because of his inability ee how much traffic is building up ither direction, this is often a diffi- job, and traffic jams are the result. ow the constable has in front of in his police box a five-inch TV en linked to two cameras, one at bridge. He can thus see the traffic before it reaches him, and can



p right—A monitor unit in a room erlooking Silver St., Durham, waits for a build-up of traffic

ove—This is what the traffic police- an sees on his TV screen, although s bridge is outside his normal view.

late its flow with greater ease and inty.

ere are, of course, many similar c problems in big cities, in which strial TV could be used to assist. hopes it can persuade others to oy its electronic eye to clear the s.

e success of the experiment may ade the town of Durham to install monitoring device as a permanent e. It has certainly demonstrated more application of electronics in modern world.

ght—Constable Dennis Stanley on cle gets a clear view of what traffic to expect.

When an oil well catches fire it can cause great danger and damage. This Californian fire covered 10 acres of tanks and buildings before it was subdued.

WHERE WILL YOU STRIKE OIL?

The widespread search for oil in Australia has created a new interest among those people who are risking their money in oil companies. Without doubt, a good oil "strike" would make an enormous difference to Australian industrial and social life.

IF you decide to dig into the old treasure chest for a few pounds to invest in some shares, you are in for quite an interesting evening trying to work out the meaning of the prospectus.

A while back I decided to try my luck in this popular gamble and sent for a prospectus of an oil search company. This is what I read:

"Pliocene rocks were laid down above the Miocene sediments. During the erosional period, development of secondary porosity in the limestones due to weathering may be expected to have occurred, which would greatly enhance the oil reservoir possibilities of these rocks.

"On some of the anticlines in the area, the Pliocene cover has been breached by erosion and the Miocene rocks are exposed, but at the base of the Pliocene sediments there is a development of thick sandstones and the limestones, indicating 'platform' conditions."

So what! To the uninitiated that stuff is utter drivel. I mean to say, how can you prove whether they are right or wrong?

That is why it is such a gamble. All you can do is to assume that they know what they are talking about, dig deep, and hope for the best.

by Calvin Walters

If you are curious you will go i the matter a bit further, and try to f out what it is all about. Even then becomes a bit complicated. You will f yourself in deep water in no time. Th no wisecrack—you might just as ea find yourself part-owner of a water w as an oil well.

What I have done here is try sort it out a bit, so that, if you inte investing a few hundred thousand pou in oil shares, you will have a fair idea your prospects (I hope). If you only w to invest a few "bob" it doesn't mat anyhow.

Scientists have been arguing for ma long years as to the origin of the found in the ground. All sorts theories have been advanced and nobo seems any nearer a solution.

Some say that quantities of calciu aluminium, iron and other carbides ex deep in the ground, and the action hot water upon them produces liq and gaseous hydrocarbon compoun which seep upwards through the ea and condense into liquids in cert earthy deposits.

ORGANIC THEORY

Others says that limestone, gyps and hot water, which certainly cont the necessary elements for the format of petroleum, are acted upon in so way and form oil.

Then again there is the theory th because some of the gases given off volcanoes contain hydrocarbon, it follo that these gases could be condensed i oil at some cooler part of the ear surface.

The theory which has the widest ceptance is called the organic theo which asserts that, from about 400-m lion to 10-million years ago, most of earth was covered by sea, around shores of which billions upon billions small sea creatures lived. These fed the marine plant life, which conti ously derived energy from the sun.

The bottom of the sea became c ered with layers of the dead bodies these sea creatures, which became mi with decayed vegetable matter and v ous salts washed into the sea by riv Whilst the chemical processes wh transformed this material into oil gas was taking place, the fine sedim of the ocean were settling down on it. Continued settlement increa the weight, until finally these sedim were converted into strata of rock.

It can easily be seen that the dr of oil and gas would rise from original mud into porous rocks, wh they would accumulate. These po rocks are either sandstone or limest

Over the span of these million years the earth changed its surface st

. Its crust rose and fell and warped, the production of valleys and moun- ranges in places where once was Cracks or "faults", as they are ed, developed in some places, while other places the land subsided and ocean came in to fill valleys between ntains.

is natural that the maximum marine mentation should take place in these , water-covered valleys, and it is ificant that oilfields today are in- ably found in these ancient sea beds. il is only found where there are ine sediments, be it in the middle desert or between mountain ranges of these have, at some time in the ote past, been under water for many uries.

UDY OF ROCKS

is in the folds and wrinkles of earth's surface, therefore, that oil ogists search for oil deposits. efore the petroleum geologist can ligently apply his art he must have e basis upon which to work. He studies the various strata of rock formations which have n formed over the centuries, and has given each a name. Starting from the surface of the earth downwards, we e what are called "recent" layers, as follows: Present, stocene, Phiocene, Miocene, Oligocene, and Eocene. Then we come to layers of "middle life", namely Upper taceous, Lower Cretaceous, Jurassic and Triassic, followed "ancient layers"—Carboniferous, Devonian, Silurian, Ordo- an and Cambrian. There are more layers lower down through periods of "earliest life" to Primary or without life, but they do not concern us.

These layers were laid down over periods of millions of years. During those years the earth's crust expanded and shrunk and deformed, so that the layers folded into characteristic shapes.

It is to these folds that the petroleum geologist pays the greatest attention, together with the age of the layers of which the folds are composed.

This folding of the layers formed traps into which the oil seeped.

There are three main kinds of traps, all of which consist of a layer or layers of porous rock covered by layers of non-porous rock.

Porous rock which has become saturated with oil may become folded upward into the shape of an inverted bowl. The oil is prevented from escaping by an overlaying layer of non-porous rock, and is trapped in the upper portion of this inverted basin. This type of fold is called an "Anticline".

ANTICLINE OFTEN HOLDS OIL

An anticline, caused by the folding of rocks under pressure, is a common source of oil in oil-bearing rocks. This diagram shows how oil and water separate out between the rock layers.

OIL TRAPS

A second type of trap is the "stratigraphic trap". This is caused by a wedge of sandstone which is situated between two non-porous layers of rock. The oil moves through the sandstone until it comes to the end of the wedge or platform and can go no further. The wedge may be of vast extent and be the source of a great oilfield.

Another type of trap is where an "anticline" may have cracked vertically down the centre. The portion to one side has fallen, and a layer of porous rock has become thrust against a layer of non-porous rock, and has sealed in the oil.

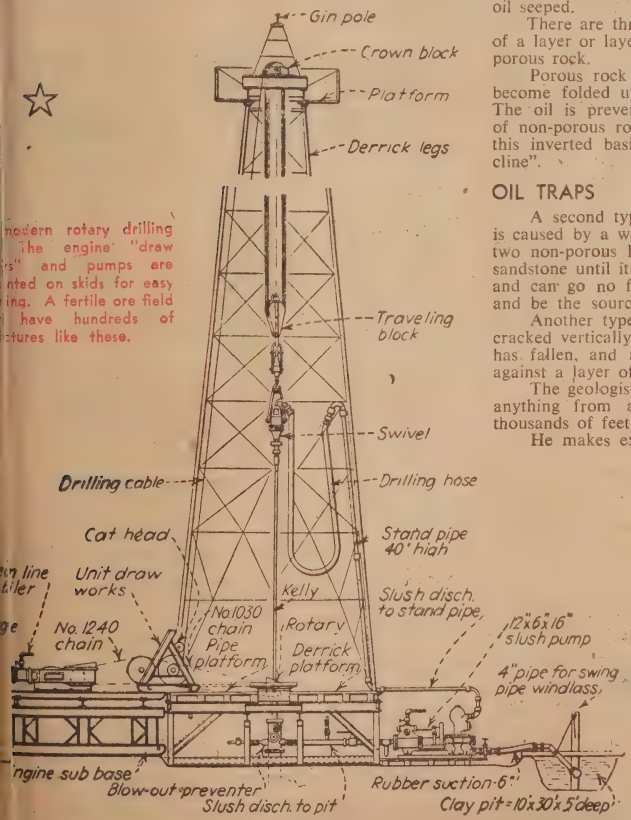
The geologist attempts to find these traps, which may be anything from a few hundred feet from the surface to thousands of feet down.

He makes extensive investigations of the contour of the land, noticing any outcrops or exposed layers of strata. These indicate which way the rocks are sloping, so that from them he can deduce whether there are possibilities of oil traps in the layers.

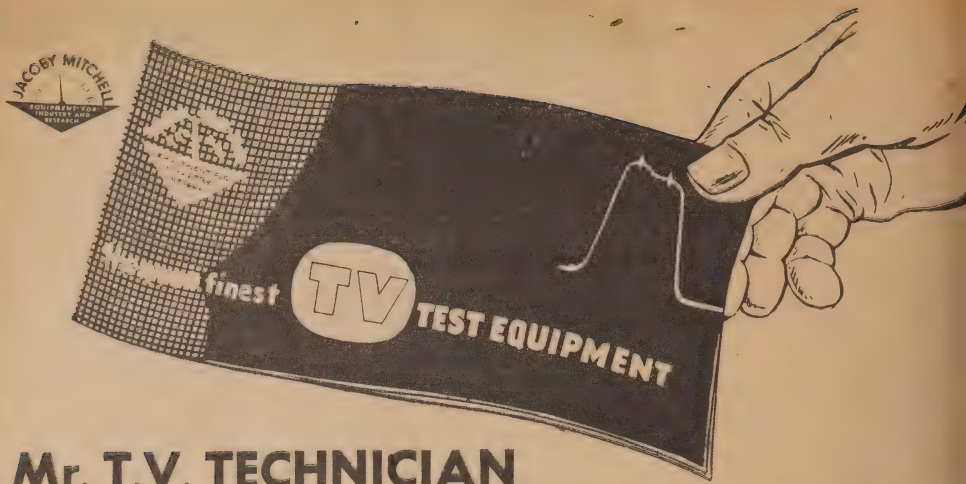
The other men in the field — the Palaeontologists—look for fossils in the layers of rock. He gets clues from them as to the types of layers, namely, Pliocene, Miocene and so on, and can predict the age of the layers and whether the formation is of a type likely to contain oil.

The petroleum geologist of today has other means to assist him. Various instruments have been devised, such as the Gravity Meter, the Magnetometer and the Seismograph.

The Gravity Meter measures the gravitational force of the earth, which varies



odern rotary drilling he engine "draw s" and pumps are nted on skids for easy ing. A fertile ore field have hundreds of tures like these.



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different places, according to the den- of the rock formations. Heavy ks pull more than lighter rocks. Rocks near the surface pull more than same rocks of the same size at ater depths.

Thus, by carrying the Gravity Meter r the terrain, the scientist obtains ormation about the character and ths of the rocks beneath the sur e.

The Magnetometer enables the geo ist to obtain further information ut the character and depths of rocks registering their influence on the th's magnetic field, which this in- ument measures.

E SEISMOGRAPH

The Seismograph measures the vibra- is of the earth, which can be caused natural or artificial earthquakes. To this instrument for oil geology pur- es, a hole is drilled in the ground a bomb of dynamite is exploded at bottom of the hole. Waves are up in the earth's crust.

These waves are altered in shape ording to the characteristics and ths of the various rock strata. Dense d rocks reflect the waves more dily than soft ones. Rocks near the face will reflect the waves sooner n deeper ones. The waves will be red according to the slope of the terranian layers.

FLECTED WAVES

These wave reflections are recorded a pen mechanism, and subsequent lysis of the results by the trained erver assists him in locating the folds faults in the rock layers, which be the site of trapped deposits of

Having studied the lay of the land detail, and made their recommenda s, the geologists retire from the scene a while and the drillers take over site is chosen to drill, and the lers get ready to "spud in"—a term n seen in the local newspapers when rting on drilling activities—and rs to the place where the first bite be made by the drill.

high steel framed "derrick" is ted over the spot. The older method drilling, called "cable tool drilling" sisted of repeatedly lifting and drop- a heavy tool on to the site by ns of a cable. This method is very in origin, having been used by the ese centuries ago to drill wells for r.

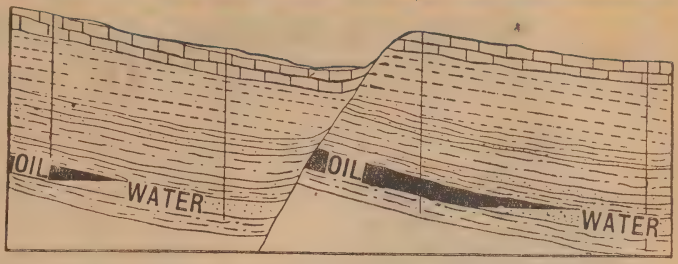
TARY DRILLING

he modern method of drilling is the ry method. A horizontal steel table he centre of the derrick is rotated a machine. This table has a pipe ched to it, at the end of which is a which may be one of various kinds ie most popular type is the roller This has steel rollers, like cog- els, which rotate and chew into the

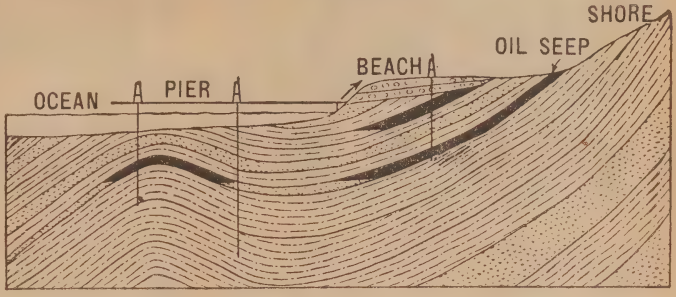
ie drill pipe is about 4½ inches in ameter. As it drills deeper into the th, further lengths of pipe are added, hat eventually it is so long that it mes flexible.

hile the drilling is proceeding, a mix- of water, clay and chemicals, called

SOME OIL-BEARING FORMATIONS



Illustrating how the up throw side of a fault acts as an anticline, while the downthrow side appears as a syncline.



When oil is found under the ocean, engineers must mount the derricks on piers.

"drilling mud", is pumped down the pipe and back to the surface. This cools the bit and lubricates it, brings samples of rock chips back for analysis, and forms a type of plaster on the walls of the hole to prevent it from falling in. In addition, it prevents oil, gas or water getting into the hole and causing what are known as blowouts which could wreck the drill.

As the hole becomes deeper and deeper, lengths of steel casing pipe are lowered into the hole. These are called "strings". Each length slides into the one ahead of it, right up to the surface. Thus the lower end is smaller in diameter than the upper end.

Cement is now pumped between these strings, and the hole is thus sealed against leakage.

It is usual to analyse the rock chips brought to the surface, but often a special bit is lowered into the hole, which cuts out a cylindrical section called a "core". This is analysed in the laboratories on the field, and the geologist can determine what type of layer the bit is drilling at any time.

ELECTRONIC MEASURE

Sometimes a device called a "logging instrument" is lowered into the well. By means of a meter the resistance of exposed rock surfaces to an electric current is measured. As this resistance varies with the character of the rocks or the presence of oil, the geologist can get some sort of picture of the inside of the well as drilling proceeds.

If the drill encounters a well of oil, the pressure moves the oil up the well. At this point the drill is removed, while the mud holds the flow back. A pipe is inserted down the centre of the drill hole, and the oil flows up this pipe to the top, where it is controlled by means of valves.

Special drills enable the hole to be drilled at odd angles, as, for instance, from dry land to under the sea. They can also be used to control wells which have caught on fire. In such a case, drillers drill into the original well from an angle at a safe distance.

The new hole intersects the original hole some distance from the surface. Heavy mud can then be pumped in, thus blocking up the original well and stopping its flow.

PRESENCE OF WATER

Those investors who have repeatedly read in the newspapers that their favorite "oil well" drillers bring up nothing but salt water need not despair. Under ideal anticlinal conditions, gas is usually found at the top of the anticline, oil below this and water on each side.

It is quite possible that the drill has been "spudded in" over the water portion of the anticline. If so, it is usually moved to a site further to one side or the other, until the oil-bearing portion, if any, is encountered.

The drill may have to be moved over many spots before the strike is finally made.

It is in the anticlines with associated sandstone and limestone that the major oil wells of the world have been discovered. Let us hope that in Australia and New Guinea nature has given us plenty of anticlines of the right sort. I might make a few bob yet.

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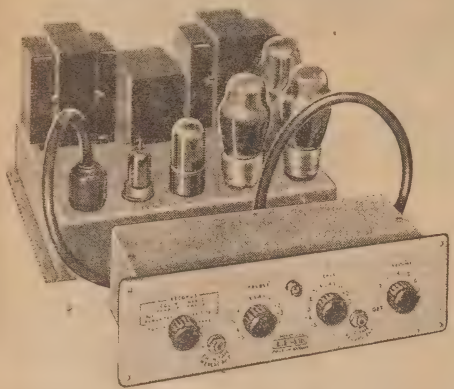

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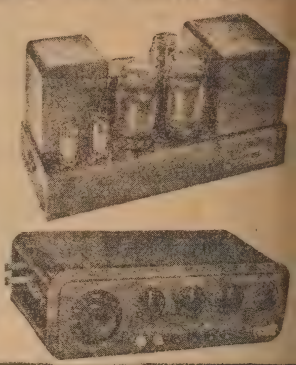

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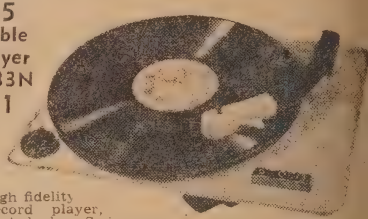

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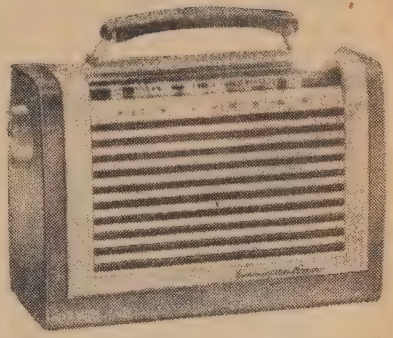
Technical Review

RANSISTORISED 7-VALVE PORTABLE

he use of transistors in American radio circuits excites o greater interest these days. Particularly in the port- ble field, new models are being produced which employ hem in all circuits, although suitable transistors for use in the RF sections of the set are not yet available here.



The RCA Transistor Seven, finished in tan colored leather and aluminium grille. It operates from a 9 volt dry battery and gives up to 300 milliwatts output.

HE receiver detailed here and recent- ly placed on the market, is known he Transistor Seven, the makers being A Victor.

s companion set is a very much ller five-transistor model, and to- er they represent a complete break- y from the more conventional valve s.

is not a cheap set by USA stan- ls, as it sells for about 70 dollars. its extremely modest battery require- is make it an attractive buy for all

is powered from a small 9-volt dry ery, and has an approximate current n with no signal of only 9 milliamps. his gives it a useful life in intermittent ice of about 500 hours.

fter the manner of Class-B audio es, the current drain increases notice- on audio peaks.

he set is 10in wide, 7¼in high, with pth at the bottom of 4in, and at the of 3in.

uses an oval speaker measuring 6 x and weighs 5¼lb complete with ery.

covers the normal broadcast band ng range of 540-1600 Kc with an IF 55 Kc.

he circuit which is shown below is a superheterodyne with a converter, two IF stages, crystal diode detector, an audio amplifier, an audio driver and a Class-B output stage.

The maximum undistorted output is 250 milliwatts, with a maximum of 300. This compares more than favorably with that of the conventional receiver using valves.

A built-in ferrite rod aerial is used which gives excellent signal pick-up and good image rejection. The IF transformers are of the permeability-tuned type providing high gain and stability.

The oscillator coil is also permeability tuned to allow close tracking throughout the tuning range, and the volume control is of a dual type to ensure adequate control of strong signals.

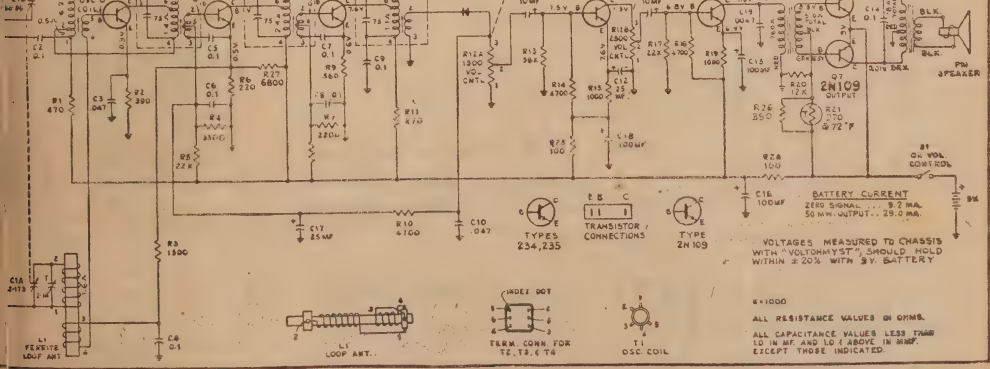
Although the receiver will naturally work best with its rated battery voltage of 9, it will still operate when the voltage has dropped as low as 6 volts.

As will be seen from the circuit diagram, which is not essentially any more complicated than a valve receiver of this size, special RF coils are needed with taps to provide suitable matching for the transistors.

An extra complication is the inclusion of the Class-B driver transformer, offset largely by the saving in battery power.

In operation this receiver gives a fine performance. It has plenty of sensitivity, and in volume and quality is equal to if not better than conventional designs.

Test procedure is not difficult, although special precautions have to be observed to prevent damage to the transistors, particularly the Class-B transistor, by the application of excess heat, or by removing its bias. It is pointed out that even the use of continuity testers with too much voltage at the test prods may cause such damage.


Q1 2N35 CONV.
Q2 2N34 1ST I.F.
Q3 2N34 2ND I.F.
CR1 1N 295 2ND DET
Q4 2N109 1ST A.F.
Q5 2N109 DRIVER
Q6 2N109 OUTPUT
DRIVER
OUTPUT
PM SPEAKER
Q7 2N109 OUTPUT
S1 ON-VOL CONTROL
BATTERY CURRENT
ZERO SIGNAL .... 9.2 MA.
50 MW. OUTPUT .. 29.0 MA.
VOLTAGES MEASURED TO CHASSIS WITH VOLTOHMYST, SHOULD HOLD WITHIN ±20% WITH 9V. BATTERY
TYPES 2N34,2N35
TRANSISTOR CONNECTIONS
TYPE 2N109
L1 FERRITE LOOP ANT.
L2 LOOP ANT.
TERM. CONN. FOR T2, T3, & T4
T1 OSC. COIL
INDEX DOT
ALL RESISTANCE VALUES IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 10 IN MF. AND 10 & ABOVE IN MMF. EXCEPT THOSE INDICATED.

The schematic circuit diagram shows the use of seven transistors and a crystal diode detector.

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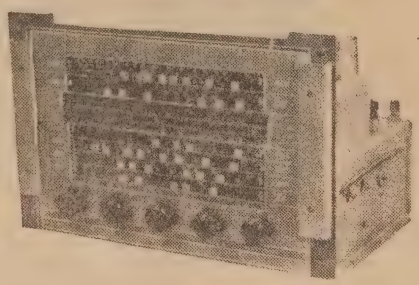

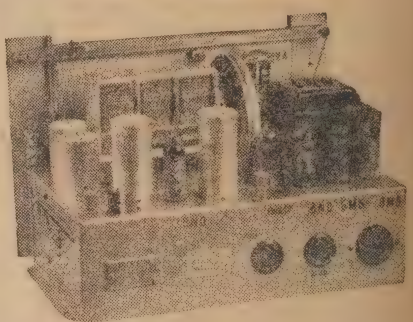

NEW • Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Philips nine pin innoval series.

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NEW • Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations of each State in prominent type. Dial fitted with counterweight drive giving smooth tuning. Indicator lights are fitted showing which band is in operation. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW • Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.

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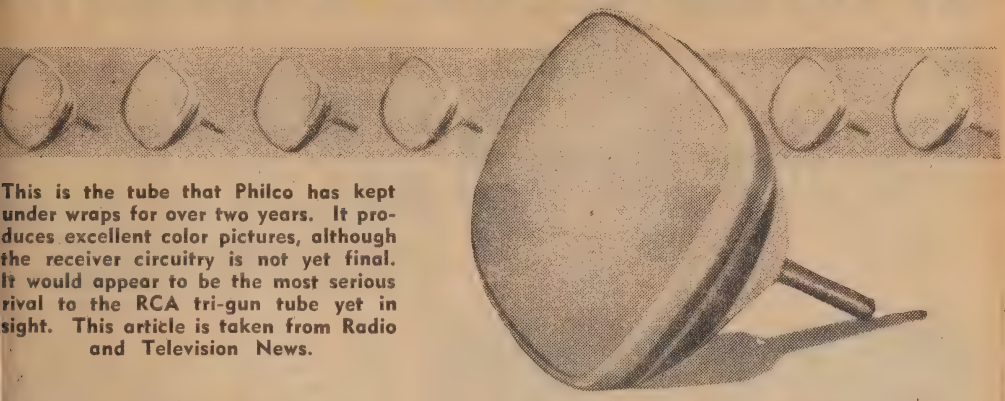
THE PHILCO APPLE — NEW SINGLE-GUN COLOR TUBE



This is the tube that Philco has kept under wraps for over two years. It produces excellent color pictures, although the receiver circuitry is not yet final. It would appear to be the most serious rival to the RCA tri-gun tube yet in sight. This article is taken from Radio and Television News.

Figure 1—The Philco color TV picture tube is shown here. The bulb used is conventional.

Finally, after more than two years of ret development, the Philco Corpora- n has divulged the principles of opera- n and the extent of development al- dy accomplished on its "Apple" color system.

At the same time, the company re- sed information on the single-gun or tube it developed to go with this or TV system. The word "Apple" has :n used by Philco as a code name for s system, which has been one of the it kept secrets in the electronics in- stry.

Basically, the tube uses a single elec- n gun to excite the vertical color)sphor stripes on the face plate. In- ad of directing the beam to a par- ilar color stripe in a regular switch- and deflecting sequence, as the Law- ce single-gun tube does, the "Apple" e allows the beam to sweep across face of the tube as in monochrome ctice, but the modulating information the beam is switched according to the iition of the beam.

DEXING SYSTEM

In other words, as the beam passes r a red stripe the red signal is pass- to the gun. The same holds true for e and green. Such a principle requires indexing system to provide informa- n concerning the whereabouts of the iting beam and a modulating system provide the required beam modula- n.

The "Apple" color picture tube, shown in Fig. 1, may be generally described as an all-glass 21in rectangular picture tube providing 260 square inches of useful screen area, having a diagonal deflection angle of 74deg., and using magnetic focusing and deflection. The color television display system described here requires a picture tube that must satisfy certain specific and unusual requirements. These are:

UNUSUAL REQUIREMENTS

1. Small spot size.

2. Two electron beams that "track" each other and have a minimum of "crosstalk".

3. A screen consisting of a repeating pattern of vertical red, blue and green luminescing phosphors arranged in lines in a precisely described fashion on the face of the tube.

4. A secondary emission index-producing structure as an integral part of the screen.

The two fundamental parts of the "Apple" system are "sequential writing" and "electrical index". The expression "sequential writing" means that the beam passes successively over triplets of fine vertical, red, green and blue stripes, as shown in Fig. 2. A particular color is produced by modulating the beam during the time it is passing over each triplet according to the proportions of primaries in the desired color.

The expression "electrical index" refers to a signal derived from the anode of the "Apple" tube itself that continuously gives information on the location of the beam. The beam current responds to two types of instructions: the color video signal from the transmitter and the index signal.

The index signal is obtained from the tube by means of the structure shown in the insert in Fig. 2. A line, called the index stripe, of a material having high secondary emission compared to the aluminised background of the tube face, is placed behind every red line. A second beam, the "pilot" beam, parallel to the writing beam, is produced at the gun and sweeps the index stripes in company with the writing beam.

PILOT BEAM

The secondary emission current produced as the "pilot" beam crosses these index stripes is collected and amplified, resulting finally in a signal at the same frequency as that at which the writing beam must be varied to produce colors.

The "pilot" beam is so aligned that it always strikes the same color line as the picture writing beam. However, the beams must be kept separate to avoid intermodulation between the

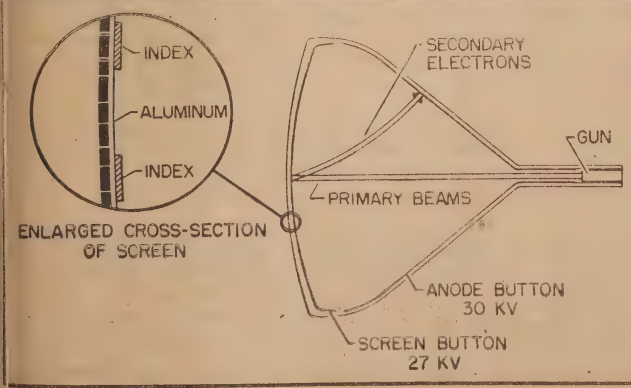
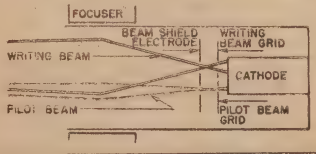


Fig. 2. Top cross-sectional view of the "Apple" color TV tube showing the path of the electron beam from the gun, and the path of the secondary electrons which are knocked off the screen and collected.

Fig. 3. Method of producing two electron beams in a single electron gun. Note the co-planar grids, one for each beam. Both beams, one for writing the picture on the screen and the other for indexing, must track perfectly if the system is to work.



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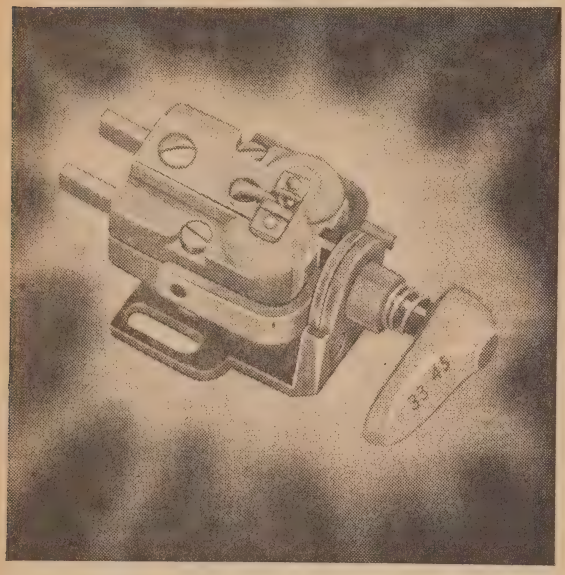

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STANLEY KELLY, "Hi-Fi News".

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P. WILSON, M. A. "The Gramophone".

★ **The famous "500" CARTRIDGE** is now fitted with a **MU-METAL SHIELD** and re-named **"555"**

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The "555" will fit all arms with ½" mountings.

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ot" carrier and writing frequency
al.

he luminescent screen or anode of "Apple" tube consists of a repeat- array of red, blue and green ver- stripes as mentioned previously, stripes are not contiguous but have 0 per cent duty cycle; that is, the es between the lines are as wide as phosphor lines themselves.

he spaces between the lines are fill- in with guard bands made of a -colored, non-luminescent ma- l which improves color saturation enhances contrast under normal ient light by reducing the reflec- y of the screen. Correct white bal- is built into the screen of the ple" tube by adjusting the relative iencies of the blue and green phos- s through the addition of varying unts of non-activated material so scanning of the screen with a con- unmodulated beam produces e.

VANTAGES

mong the important advantages of "Apple" tube is its similarity to k-and-white tube. In fact, in the nce of a chrominance signal, it can help making a good black-and- e picture. None of the writing n in the "Apple" tube is intercepted deflected in such a way as to waste high voltage power, and there is problem of matching the character- s of three guns to obtain good col- ietry.

he color saturation obtainable at any icular brightness level is obviously ed by the spot size at the beam ent associated with that brightness. ie spot is too large to land on one iary color stripe at a time, then de- ration of primary colors occurs.

his consideration, plus that of reason- structural resolution, made the de- pment of an electron gun producing ot substantially smaller than usual in onochrome tube, a prime necessity this beam-indexing tube.

AMS MUST TRACK

combination of a small, counter- aperture and close cathode-to-grid ing is primarily responsible for ob- ng a greatly reduced spot size.

second requirement is that the two ns "track" each other. Since one n is used to tell where the other n is, the relative position of the ns must be known at all times. The beams are formed close together by g a single cathode, and two separ- co-planer, control grids, each with perture close to the end of the grid. e ends being separated by .002 inch. ie centre-to-centre separation of the beams at the grid plane is only .029 . See Fig. 3. This setup assures good cking", since both beams are so close ther that they will be acted upon in tly the same amount by deflecting s, etc.

ie third special requirement of this n-indexing tube arises from the need preventing the control voltage of one n from affecting the intensity or tion of the other beam. This is satis- by using a simple shield between two beams in the region just above grid apertures. This shield, shown in 3, effectively eliminates beam "cross- " as a limitation on the functioning ie system.

ie final unique feature of the Philco beam-indexing color tube is the index structure, which provides the required continuous monitoring signal. This signal is generated by the difference in secondary emission between an array of magnesium oxide stripes applied to the gun side of the aluminised screen and the bare aluminium between these stripes. There are two contact buttons on one side of the tube envelope, and one of these is connected to the screen aluminium coating making it possible to maintain the screen potential at approximately 27 kilovolts. The second contact button connects to the bulb coating which is maintained at 30 kilovolts. The three kilovolt differential between screen and bulb coating results in the collection of the secondary electrons from the screen by the bulb coating.

INDEXING SIGNAL

To obtain the indexing signal, an external band of a conductive coating encircles the screen viewing area to form a coupling to the screen aluminium film. A metal mounting band is strapped over this coating and is used to support the tube and yoke-focuser cup in a manner similar to monochrome received practice. The mounting feet, which support the assembly in the cabinet, are insulated from the metal mounting band, but are grounded to the foil shield.

The circuit elements formed by the band, the aluminised screen to which it is coupled, and ground, are tuned to resonance at the index sideband frequency. Index signal take-off is accomplished by a coaxial lead connected to the mounting band. To shield the index circuit from external interference, an aluminium foil shield is folded to cover the rim of the CRT. The tube and circuitry do not appear sufficiently sensitive to magnetic fields to require any magnetic shielding or compensation for earth field effects.

BLOCK DIAGRAM

Fig. 4 is a block diagram of the circuitry of the receiver. This is one version of a complete "Apple" receiver. The circuits shown in the light dashed lines follow conventional color receiver practice and the "Apple" receiver imposes no special requirements here. The remainder of the receiver outlined in heavy solid lines is shown in four separate sections: the index amplifier, the "pilot" carrier oscillator and color mixers, the writing frequency amplifier, and the horizontal sweep and high voltage.

The horizontal sweep-high-voltage section is similar to monochrome practice. Some details include the use of a pair of 6CD6 tubes for horizontal drive, and a special high-permeance diode, the L-1379, as the damper. The 30 kilovolt supply is obtained by a voltage doubler using 1B3's.

To aid in maintaining horizontal sweep linearity with changes in line voltage, and to maintain a nearly constant picture height, it appears advantageous to derive the plate supply voltage for the horizontal and vertical oscillators from the regulated energy in the horizontal system.

Vertical dynamic focus only is used in this receiver; for this, a vertical frequency parabola is applied to a focus control tube. The high-voltage supply must have two regulated outputs in order to maintain optimum focus, horizontal sweep operation, and index. This has been accomplished by use of two all-glass gas regulators.

The mixer unit consists of two tubes whose triode sections accomplish nearly all the color signal processing required by the receiver. The functions of this section are to generate an unmodulated "pilot" frequency carrier, and to transfer the chrominance modulation to a second "pilot" frequency carrier. The latter signal is mixed with the amplified index information derived from the CRT to form a chrominance-modulated writing signal which includes the positional information of the index signal.

This receiver, as a developmental type, does not use an excess of dual-section tubes, yet its complement is only eight tubes more than a shadow-mask receiver containing the same non-display circuitry. In the foreseeable future this differential may be not more than five tubes.

Against this disadvantage are the potential advantages of an electron optical system requiring only two alignment adjustments and a cathode-ray tube completely free from static and dynamic white balance, and magnetic field problems.

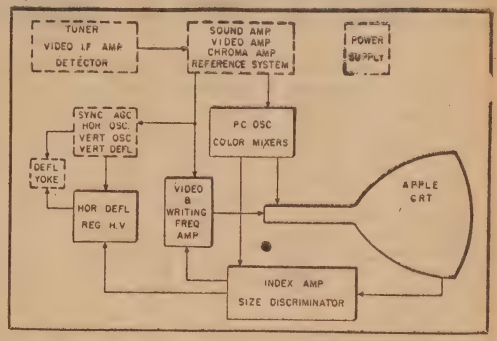


Figure 4—Block diagram of developmental color TV set using single-gun color tube described in this article. The circuits enclosed in the solid boxes are peculiar to the "apple" system.

A new concept in electronic receiving tube manufacture was revealed recently when Eitel-McCullough, Inc., San Bruno, California, released information on a new Eimac stacked ceramic receiving tube. The company developed the new tube under Air Force contract to provide a small unit which would withstand environments found in airborne and missile applications. Life of the new tubes is so long that they will be wired directly into the equipment thereby eliminating need for tube sockets.

TV
TEST INSTRUMENTS

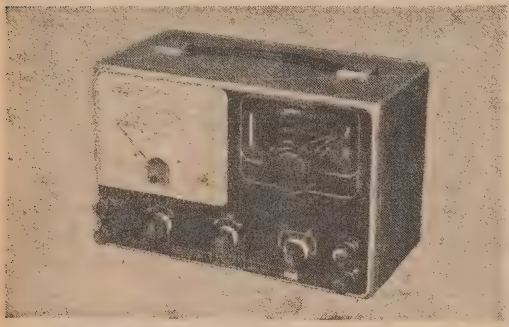
by **UNIVERSITY GRAHAM**

Electronic Volt Ohmmeter (V.T.V.M.) Model TVR-EV (BELOW)

This smartly styled Electronic Volt Ohmmeter is suitable for TV and radio servicing and employs a large 8-inch illuminated meter. It will measure negative D.C. voltage, positive D.C. voltage and A.C. voltage in steps of 1, 3, 10, 30, 100, 300 and 1,000 self-contained. Peak-to-peak A.C. voltages may be measured up to 2,800 volts. There are seven ranges of resistance up to 1,000 megohms and the D.C. voltages can be extended to 30,000 volts by use of the external probe Model TV30. Crystal probe and valve probe enable RF voltages up to 1,000 to be checked, and the wide frequency response makes it entirely suitable for TV servicing and other applications.

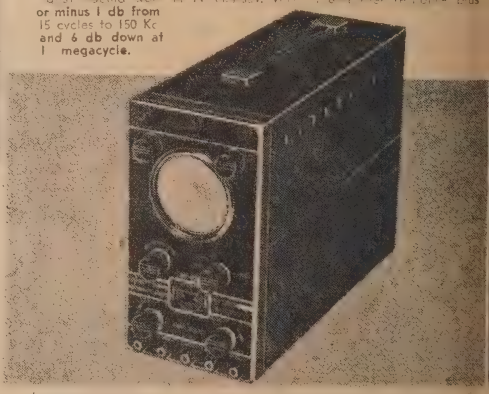
Transistorised Field Strength Indicator and Aerial Compass, Model TVR/FS (Below)

For the installation of TV aerials for the best results it is necessary to have a Field Strength Indicator such as the one illustrated here. Entirely portable and self-contained this Transistorised Electronic RF Voltmeter helps in location and orientation of aerials, and simplifies installation and this saves time. Provided with carrying strap to be worn around the neck or over the shoulder it leaves the hands free for adjustment and for carrying the aerial provided with each Field strength indicator. It covers from channel 2 to 10 continuously tuneable and is calibrated in channel numbers. Only 7lbs in weight it is light, easy to carry and is ruggedly constructed.



Oscilloscope 3-inch, Model TVR/C3 (below)

Small and portable, this Cathode Ray Oscilloscope is invaluable for TV and radio service work as well as industrial use. Although compact in size it contains the features of larger instruments, is flexible in use and offers many new features. It is suitable for the visual alignment of TV receivers and direct access is possible to both horizontal and vertical plates for examination of strong voltages. It can be supplied with a demodulator probe for visual aligning work in TV receivers. Vertical amplifier response plus or minus 1 db from 15 cycles to 150 Kc and 6 db down at 1 megacycle.



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- Valve Tester TVT/2.
- 5in Oscilloscope TVR/C5.
- Multimeter TVR/MM.
- Pattern Generator TVR/PG.
- Resistance Capacity Tester VBA
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- Picture Tube Adaptor.

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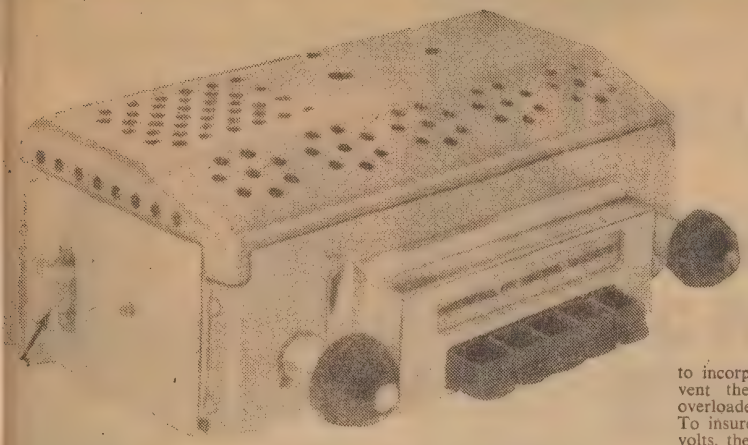
HIS NEW CAR RECEIVER USES NO VIBRATOR UNIT



This outside view of the new Motorola car radio shows the transistor indicated by an arrow It is mounted outside the case to assure stable operation in a heat radiator for cooling. There are five stations selected by push-buttons in addition to normal turning.

Details of a new auto radio set available in USA, which operates direct from a 12-volt battery, and uses a transistor output stage. Thus no high-tension power unit is required.

[ANY of the new automobile models are featuring the recently developed otorola auto radio, the model BKA6T, ich combines low "B-plus" type vac- n tubes with a transistor-powered out- stage This combination eliminates the need a vibrator type of power supply to rease the battery voltage to a high value.

These radios are now designed to op- te off 12-volt auto batteries only. Because it operates directly from the o battery, the circuit design is some- at different than that of conventional lios. The general appearance of the lio is the same as conventional models cept that the transistor is mounted to- her with its heat radiator on the out- e of the cabinet.

The antenna input circuit of this radio is conventional except for the use of a high-pass filter, composed of R1 and C3.

These components function to eliminate 60-cycle noise present in areas of low signal strength and where there are power lines. This network passes the high-frequency radio signals to the grid of the RF amplifier but shunts the 60-cycle noise to ground.

The RF amplifier stage is fairly conventional, with one exception. The RF tube is cut off when the AVC voltage reaches a level of approximately —6 volts. When the RF stage is cut off, the incoming signal is fed directly to the grid of the converter stage by means of the interelectrode capacity of the tube.

A signal strength of about .1 volt will result in —6 AVC volts. It is necessary to incorporate this feature so as to prevent the converter stage from being overloaded due to the low plate voltage. To insure the tube being cut off at —6 volts, the AVC voltage is applied to the suppressor grid in addition to the input grid of the RF amplifier.

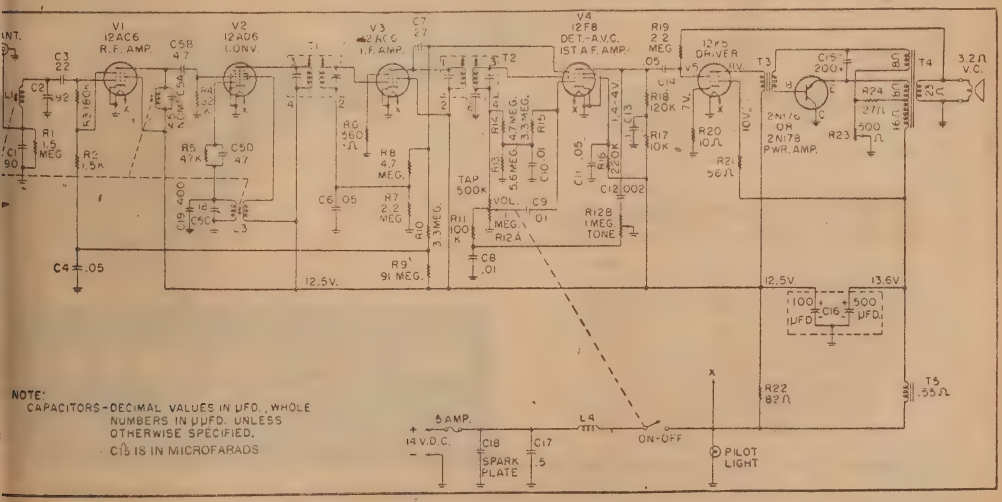
The secondary winding of the converter oscillator coil is so connected that the screen current is carried through the winding. This is done to provide stable oscillation even when the car's battery is as low as .9 volts.

The suppressor grid of the IF amplifier is grounded through a 560-ohm resistor (R6) to provide a means of regeneration, which increases the gain of the stage. Gain is important in this stage because the gain of the RF stage must be controlled to prevent distortion in the converter stage.

It will be noted that the AVC voltage applied to this stage is tapped from the AVC load and is not the full AVC developed.

As the transistor is basically a current amplifying device, the input signal to the transistor should be in the form of a

(Continued on Page 47)



The circuit diagram of the 12-volt, transistor output car radio.

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Dimensions:
2.9/16in. high, 2.3/16in. wide. 1in. stack.

Type	Primary	mA	H. T. Volt	Filament Rating
U or F30/150	230/240	30	150/150	6.3v/1.7a

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NEWS AND VIEWS OF THE MONTH

USTRALIA'S TV services are finally on the way. After so many years of ig "just around the corner", pro- ns are at last being broadcast regu- y, although it is made clear that op- ions are to be regarded more or less a training period until the official ting date of November 4th. his stage has not been reached with- a series of incidents. Most publicity has been given to out- ken parliamentary comments about use by one manufacturer of an IF in region of 21 Mc, and the danger of rference to sets using this frequency, ch is not the same as that mentioned he Australian TV standards.

here has obviously been some con- ed thinking on this point, and some e unjustified conclusions assumed by se whose job it was to know better.

TERFERENCE SOURCES

he main source of suspected interfer- e, if experienced, would have been n transmitting amateurs using one of r internationally granted bands, which lso in the region of 21 Mc. It is pos- e, too, that harmonics from amateur smitters operating on their lower quencies may coincide with the IF d by these TV receivers.

he use of 21 Mc for TV IF channels customary in America before the amateurs were granted the use of their band in the near vicinity, and it is true that convention in that country is now to avoid using it.

But it is quite wrong to assume that interference from this source is inevitable, or even likely.

FAVORABLE TESTS

In fact the Australian company has submitted its receivers to extremely drastic tests with nearby amateur stations, according to report, only to find that they are quite free from any bother. It has further offered a guarantee that any purchaser who does experience such interference will have a claim upon them until clean TV reception is obtained.

Surely it is then presumptuous for the Government to contemplate severe action in a matter which is at the most only a possibility, and which so far has not proved a problem.

As to the wisdom of using 21 Mc for TV sets that is the business of the manufacturing company. It knows as well as anyone that the PMG has told amateurs they will not be held responsible if their activities interfere with such receivers in this manner. It knows, too, that it is impractical for the PMG to keep more than one set of IF's clear of possible trouble.

But if it is able for its own reasons to use any IF it chooses, and still make good receivers, then the public which buys them won't know the difference.

In our view there is every reason why the recommended IF should be selected by manufacturers, who thereby remove any possibility of such difficulties. For who knows that, in the future, other services not yet in operation will be responsible for interference which at present we cannot envisage?

But it is only fair to emphasise that, until this happens, or is certain to happen, the matter certainly does not merit a severe legislative step.

Nor is it a fair thing to plant in anyone's mind the idea that amateurs must automatically be suspect if TV interference is experienced.

AMATEURS' RECORD

An analysis of TV set troubles shows that amateurs are a long way down on the list of proved offenders, so much so as to render them quite a minor source of trouble. It is an unjust assumption that amateurs, who have their own hard-won place in the sun, should automatically be a target for suspicion when a funny looking wiggle appears on a screen, or an unaccustomed noise in a receiver.

TV set buyers were understandably wrath to read of a £7 excise placed on all TV tubes by the recently released Federal Budget.

POPULAR SCIENCE QUIZ

Q: How hard does a bee work?

A: No one has been able to tell precisely how many bee hours of labor go into a pound of honey, nor the exact number of flowers visited. However, bees have been observed at work under varying conditions and credited with visits of up to 20 flowers per minute, making about 10 trips per day. Bees have been also credited with a regular union day of eight hours gathering honey. These figures can give some impressive approximations. If for example, it were possible for a single bee to gather all the nectar for a pound of honey, it would have to work 365 days in the year for more than eight years.

Q: Is ball lightning an optical illusion? If not, what is it?

A: Ball lightning is not an optical illusion, but a real physical phenomenon. Moreover there are two distinct kinds — the noiseless and the explosive type. According to British scientists, ball lightning is probably a dense, high-temperature globe of electrons and positively charged ions, or molecule-fragments. It is formed in the region of high temperature and pressure where the lightning stroke from the clouds meets the partner stroke from the ground. It does not happen often —the required temperature and densities are too great. At sufficiently high temperatures and densities lightning balls are stable and may last for some time. They either gradually melt away or, if the density falls fast enough, they explode with a bang.

Q: Would radiation be a major hazard in the event of an atomic explosion?

A: Radioactivity from an atomic explosion is not a major hazard, though it would be responsible for approximately 15 per cent of the fatalities. Wounds and burns would account for the other 85 per cent. To simplify the picture it is best to regard the casualties of an atomic explosion as the result of mechanical destruction.

Q: What effect do cosmic rays have on the average human life span?

A: According to an internationally-known atomic scientist, cosmic rays beating down from the outer space with other naturally occurring forms of radiation, lop approximately six weeks off the average human life. Naturally occurring forms of radiation come from foods and some 50 chemical twins, called radio-isotopes, present in the human body. Human beings also carry microscopic amounts of uranium and radium which give off invisible energy bursts.

Q: How effective are thunderstorms as rain producers?

A: A scientist reports that thunderstorms are actually inefficient rain producers. Most of the moisture and energy in the storm is dissipated without falling as rain or appearing as lightning. Only one out of every nine potential drops in the storm actually falls to the ground as rain. About one third of the potential moisture that passes through the thunderstorm never condenses to raindrops. Another third turns to rain but evaporates again as it moves in the down-draft that lies in the heart of the thunderstorm during its later stages. Of the remainder, only a third actually falls as rain. Part evaporates from the sides of the individual thunderstorm cell, and part remains as vapor in the cloud that is left behind by the storm. Nevertheless a thunderstorm has been estimated to dump 110,000 tons of water over a maximum area of eight square miles.

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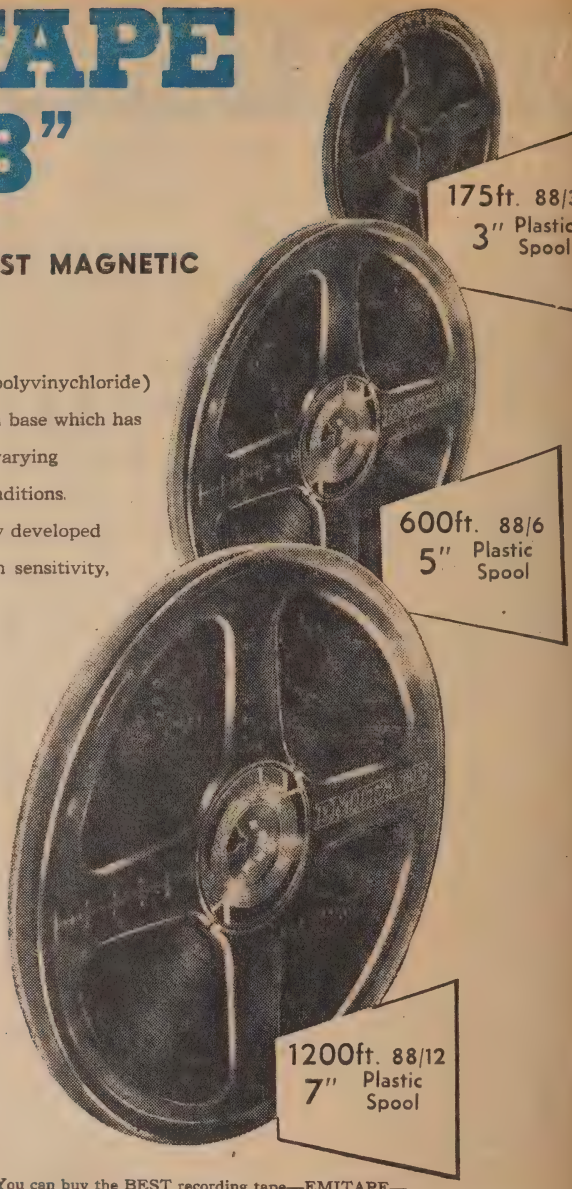

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TR.11.PP

aving at last embarked on the long-
ted TV service, and discovered that
ost of receivers is even higher than
ad hoped, it was a vicious impost
ug each and every one with such a
cial penalty, particularly as the £7
grown to a larger sum by the time
purchasers were asked to pay for
new pride and joy.

ne would have imagined that the
ency would have been to make it
r, not harder, for people to buy TV
Their cost is such that many can
hope to own their own on a time-
ent basis, and here again, the tax
ime payments has added to the over-
ost.

T FOR EXPLOIT

V should not be regarded as a new
convenient method of extracting
consolidated revenue. But however
may look at it, what other conclu-
can be drawn from the Govern-
's action? One wonders how long
ll be before the TV licence fee will
a similar fate. Not long, we fear,
growth of TV is as rapid as many
le hope it will be.

he proposal of many local councils
harge a 10/- fee for TV aerial in-
tion is another move which looks
much as though they, too, would
to be in the racket.

hat possible justification can there
or such a step?

urely there is at present adequate
ection for anyone who is likely to
dversely affected by the appearance
TV aerial or anything else on his
hbor's chimney? If it falls down and
ages a fence, as the chimney itself
ht conceivably do, isn't there a re-
s?

r do councils seriously ask us to
ve that an inspection is worth 10/-,
s likely to occupy a local engineer
that amount of time? The buyer
badly-erected aerial is more likely
e on the doorstep of the man who
it to him, without waiting for any
n from the local council.

is entirely possible for any TV
owner in the vast majority of cases
nake and erect his own aerial at the
of a few shillings, using a structure
t enough to be lifted by his little
r. How foolish to imagine that such
innocuous device should merit the
or of a council visit!

NSIBLE APPROACH

would have been far more sensible
ave suggested some action in respect
erials over a given height, or weigh-
more than a stated amount, before
council could consider itself in any
interested.

nd such limits would in the name of
mon sense have to be far beyond
e which apply to the average struc-
a householder is likely to buy.

s it is, the uninformed layman can
pardoned for imagining that he must
necessity use an elaborate aerial sys-
to get good results. The truth is
thousands of people will do just
vell with simple indoor aerials, leav-
anything more elaborate to those in
nt or difficult places where extra
up is needed.

et us be very careful that we don't
ound TV with a host of absurd ideas
omplication and cost far beyond any-
g merited by the installation of a

For better TV reception it pays to instal

CHANNEL MASTER

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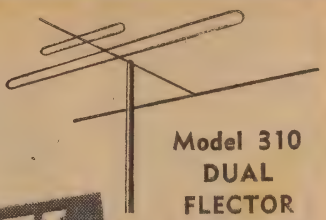
Already Channel Master TV aerials are demonstrating their superiority in Australia. Tests in Sydney, Newcastle, Wollongong and Katoomba have been remarkably successful in picking up clear pictures from TCN Channel 9 Install one yourself and prove it.



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All Band with excellent directivity for areas close to transmitter where interference is bad. Perfect "loft" or ceiling aerial.

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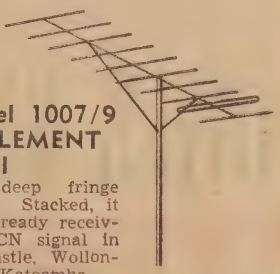

Model 1007/9 10-ELEMENT YAGI

For deep fringe areas. Stacked, it has already received TCN signal in Newcastle, Wollongong, Katoomba.

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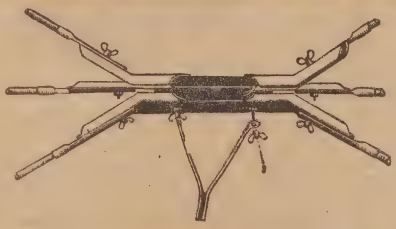

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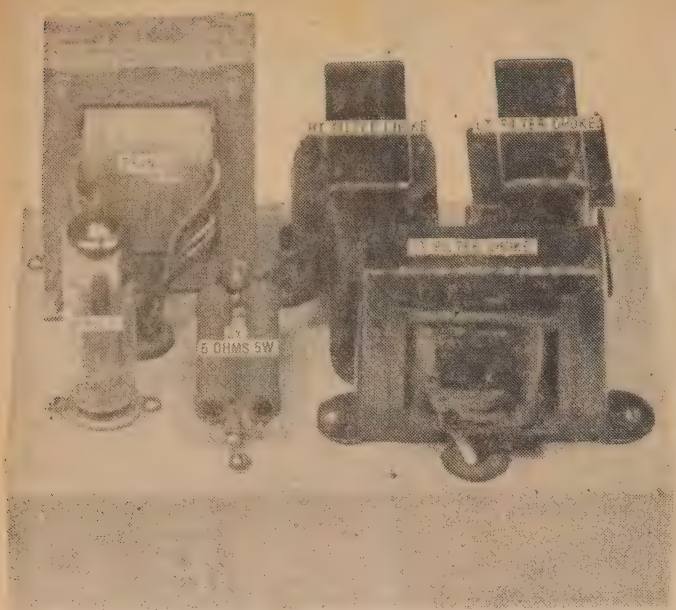


This top view illustrates the placement of the major components. Left to right and directly after the rectifier is the high tension filter choke, followed by a low tension filter choke. The second low tension choke is in the foreground. Note the method of mounting the centre-tapping resistors.

POWER SUPPLY FOR PORTABLES

The family portable receiver can become a very handy "second set" around the house, if provided with an AC power supply to replace the batteries. By simply connecting the set to the unit described in this article, it will run for hours at practically no cost.

by Wes Yashin

PORTABLES have been po ar in this country for years; in fact, ever since the 1.4-volt series of "dry-battery" valves were introduced on to the market.

However, for all their attractiveness, the use of such sets ends largely with the out-of-doors, because of the high cost of battery replacement. It simply isn't a proposition to run them for hours on end to provide background music.

A power supply which will replace the batteries for indoor use therefore has obvious attractions.

In point of fact, we designed just such a power unit some years ago and it proved very popular, indeed. Of late, the demand for the circuit has become so urgent that we decided to present it again, with a few embellishments.

NO SPECIAL PROBLEM

As we have mentioned on other occasions, there is no special problem about powering portable receivers with series-connected filaments—those operating from a 7.5 or 9.0 volt A-battery.

In most cases, such sets have been designed with an eye to possible mains operation and the problem of providing filament and high-tension supply at a total current drain of just over 60 milliamps is not very difficult.

The real problem has always been to provide power for sets with parallel connected filaments—those operating from a 1.4-volt A battery. It was this problem which our original power unit set out to solve.

In the new version we have retained essentially the same specifications—that is, a high-tension supply of 67½ or 90 volts, and a low-tension supply of 1.5 volts.

No special difficulty is involved in the design of the high-tension supply, th requirements being a small power trans former, a rectifier, and the component for a simple filter system.

A couple of resistors, arranged as divider, reduce the DC output voltage t the requisite figure.

The filament supply, however, pre sents quite a problem.

Battery valves cannot be operate from AC, as it would be equivalent t injecting a 50-cycle signal into each gri return circuit.

Even if this were offset to a degre by centre tapping the filament circuit, th filaments would still vary in tempera ture, in sympathy with the alternatin voltage, causing a severe hum to b heard in the speaker.

Mere rectification is not sufficien since the heating cycles are exactly th same as for AC, and some method c filtering is necessary to smooth out th ripple from the rectified supply.

RIPPLE FREQUENCY

This ripple must be very low, indeed if hum is to be avoided, both from varia tion in filament temperature and fron direct injection into the grid circuit.

To demonstrate the difficulties of low tension filtering, it is only necessary t quote typical figures. Taking a typica personal portable, the filaments draw 0.2 amp. at 1.5 volts, which represents resistance of only 6 ohms.

The ripple frequency is 100 c/s and to be of any use, the reactance of th filter capacitance must be low and th choke reactance high compared with th 6-ohm load. At the same time, th choke must present a very low DC re sistance and be capable of carrying 0.2 amp.

The largest commonly available filte condenser is a 500 mfd. electrolytic which has a reactance of about 3.2 ohm at a 100 c/s—not a very promisin figure.

A typical filament choke has an in ductance at 2 amps of 17 millihenries This represents a series reactance of 1 ohms—perhaps a little more with on 0.25 amp. flowing.

OTHER SOLUTION?

From the foregoing it is obvious th the filter components available cannot b expected to deal summarily with th ripple content, and some other solutio to the problem must be found.

A further difficulty stems from th fact that the regulation of a rectifie filament supply cannot be relied o Thus, if one or more filaments shou fail, the remaining ones would recei an increased voltage, due to the d creased load.

In spite of these difficulties, the circu

finally evolved is both practical and proof.

he only cheap rectifier available to ly the filaments is a full-wave type, ch normally requires a centre-tapped ly winding. However, it transpires small power transformers suiting high tension requirements have only ngle 6.3-volt winding, with no centre brought out.

ort of specifying a separate or a ial transformer, we had no choice to use the normal 6.3-volt winding a standard 30 mA power trans-ier.

n electrical centre tap was achieved connecting two 5-ohm 5-watt re-rs across the winding. The load im-d on the winding is 3.6 watts and dissipation in each resistor is just r 2 watts.

ese resistors are fairly critical, as er values would produce too much drop, while lower values would load winding unduly.

ou will note that the filter is a two on type, involving two iron-cored es and two filter capacitors. How-the final filter capacitor is replaced a 1.5-volt torch cell—seemingly a r strange choice.

NS VARIATION

practice, a torch cell has a very internal impedance and, at its op-ng potential, provides the same de- of filtering as an extremely large citor, thereby obviating the hum lem.

further advantage of using a torch in this position is that it provides ation of the supply voltage, so that utput voltage does not rise appreci-over 1.5 volts, even with no load rcuit.

kewise, variations in load or fluctua- of the mains voltage have no ap-able effect on the filament supply. then, is the solution both to the ng and the regulation problem.

e torch cell more or less "floats" s the supply, and should need re-ment only at rare intervals. When num level begins to increase, it is to spend a shilling on another try.

is interesting to note that, since our nal design appeared, a cell has been duced overseas especially designed his "ballast" service. To the best ur knowledge, such ballast cells are available locally, but a standard cell remains as a good substitute.

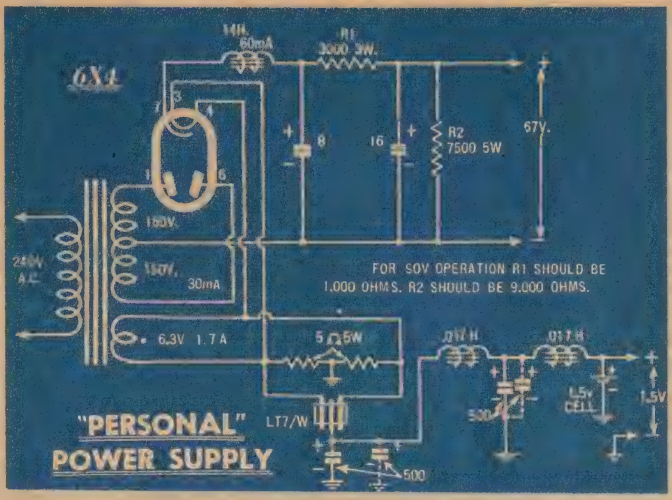
e filament supply is not completely from ripple, but you will be hard o it to hear any hum from a per- portable, remembering its small er and its limited response at 100 Larger portables may exhibit a but not objectionable hum level.

D RESISTOR

e high tension supply is quite con-nal. A 6X4 rectifier is used in a ave circuit. Its heater operates the same winding as the filament er, but complete isolation of the and "B" supplies is obtained by t of the separate cathode.

e filter is of the choke-input type. s followed by an 8 mfd. filter capa-Next comes a resistor, which as a filter and dropping resistor, wed by a 16 mfd. second filter itor.

PORTABLE POWER SUPPLY CIRCUIT



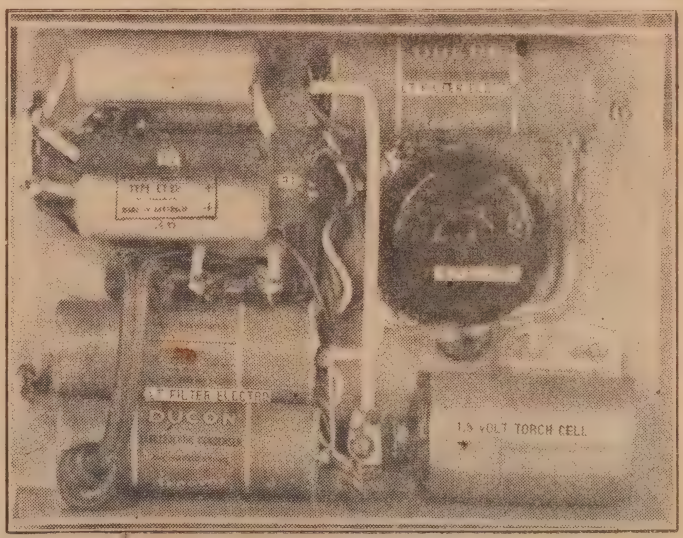
The circuit is quite simple, its main feature being heavy filtering. The low tension filter electrolytics shown by the dotted lines may be added for improved filtering. We used two in the first position, only one in the second.

Across the output you will notice a bleed resistor. The dropping resistor and the bleed resistor can be so proportioned as to give an output of either 67½ or 90 volts.

The values shown in the circuit are for 67½ volts. For 90 volts operation the 3000 ohm resistor should be reduced to 1000 ohms and the 7500 ohm resistor altered to 9000 ohms.

To safeguard any back-bias arrangement which a receiver might use, the "B" minus, represented by the transformer centre tap, is not earthed. This point must be watched when wiring the supply.

Now for the constructional layout. Our own supply was built on a chassis measuring 6½ x 4½ x 1½. We bent it up from 16 gauge aluminium, although 18



In this underneath view, all the smaller components are clearly visible. We used the large type of low tension capacitors, because we had these on hand. Using the latest miniature types, the chassis should appear less crowded. Note the battery mounting bracket.

THE WARBURTON FRANKI PAGE

Everything for the Radio Hobbyist—Check it each month

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ge would do if the chassis is made
n ends. Ours was without ends, be-
se we reasoned that the average work-
pper would have no difficulty in dup-
ting a chassis involving two simple
ds.

Component layout is not critical, al-
ugh for convenience we suggest that
follow the original design.

Most of the essential details will be
arent from the accompanying photo-
phs.

The metal rectifier is mounted under
chassis, simply because it does not
erate any heat and there are no ven-
tion problems. The 5-ohm 5-watt re-
ors, however, generate an appreciable
ount of heat and it is desirable to
nt these above the chassis, as indi-
ed.

SULATE THE PIGTAILS

The earthy end of these resistors is
hored to a solder lug on the chassis.
opposite ends pass through two
es in the chassis and terminate on a
nting strip which is retained by one
the transformer mounting bolts.

Do not forget to slip some insulating
ve over the pigtails which pass
ugh the chassis. As an alternative,
holes could be made large enough
ake ¼-inch grommets.

The method used to mount the "filter"
ery is worth special mention. The
tive contact consists of a threaded
nting pillar, securely bolted to the
ssis. To the top of this pillar, a ¼in
e strip of 22 gauge brass is attached;
is bent down along the length of the
ur and doubled up in a sharp loop.
orm a spring contact.

The negative contact also acts as the
ery retaining clip. A 1¼in wide strip
brass is bent to an arc (the battery
be used as a former), two flat por-
s on either end being retained.

The top end is bent back at right
les for about half an inch, the circle
pleted, the two ends are gripped firm-
a vice and drilled to take two 1/8
s.

The bottom portion of the brass clip
nchored securely to the chassis using
x 1/8 brass bolts. The protective
er covering is slipped off the battery,
h is then inserted into the loop and
right-angled top portion is slipped
the protruding brass bolts.

Two nuts are used to retain the top
tion of the clip and the action of
wing these down closes the loop.
ping the battery securely.

Before finally tightening these nuts,
e sure that the positive terminal of
battery is making a good contact with
positive spring terminal.

NNECTING TO THE SET

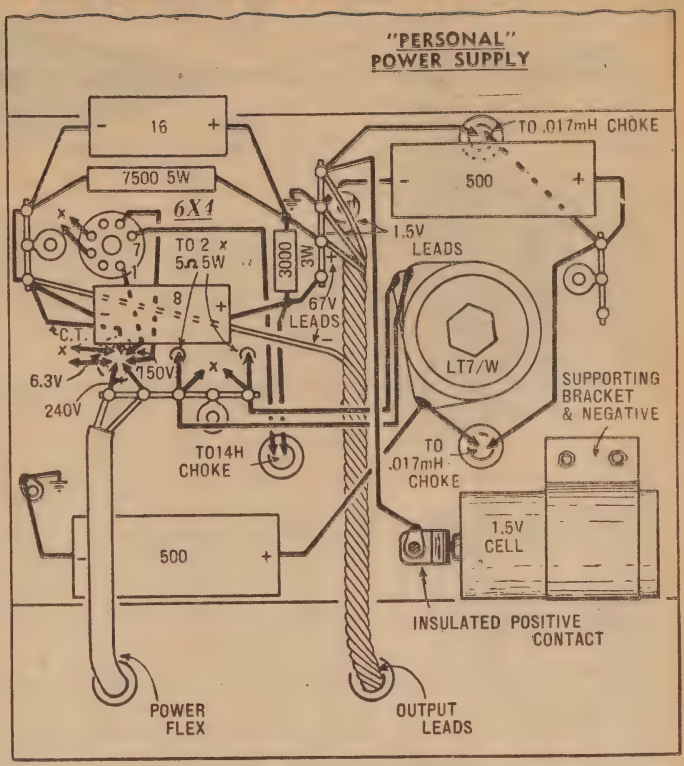
The method of connection to the re-
er will vary with individual types.
found it convenient to bring out the
and "B" supplies in a multi-colored
e of twisted hook-up wire.

ow the cable is best terminated will
with individual requirement. Many
mes suggest themselves, such as the
of sockets from discarded batteries,
to mate with the plugs provided in
receiver.

e completed unit may be housed in
x measuring 6 7/8 x 5 x 5¾ inches.
box may be made of leatherette-
red plywood, lacquered plywood, or
ed plastic. We may have more to
bout this last idea next month.

ternatively, you may prefer to modi-
ings and fit the whole "works" into

POWER SUPPLY WIRING DIAGRAM



This layout will help you to place the components and wiring when building up the unit.

a box which will better mate with or attach to your particular set. There is room for plenty of ingenuity along these lines.

WATCH THE HIGH TENSION!

To end this discussion of constructional details, a word of warning may not be out of place. Don't forget to switch your portable off in the normal manner, as well as at the mains. Otherwise the filaments will remain on and the "filter" battery will be discharged.

Readers who may be inclined to use "junk-box" resistors in the high tension supply, or who wish to experiment with values, must keep in mind that it is not wise to operate receivers with more high tension voltage than originally intended.

Under these conditions the current drawn may be excessive. Bias and supply resistors for example, determined on the assumption of 67½ volt operation, may be quite unsuitable for 90 volts.

Readers taking voltage readings on the high tension supply, should be aware of the fact that these will have no meaning unless the supply is under a correct load.

The resistor values specified assume high tension drain figures which are typical for "personal" or full-sized portables.

PARTS LIST

1 Chassis 6½ x 4⅞ x 1½ inches.
1 Power transformer 150V 30 mA 6.3V 1.7A.
1 14/60 choke (CF 102 or similar).
2 LT chokes (CF 115 or similar).
1 LT7/W LT rectifier.
1 6X4 valve.
1 7 pin miniature socket.

CAPACITORS

2 500 mfd 12v electrolytics.
1 8 mfd 350V electrolytic.
1 16 mfd 350V electrolytic.

RESISTORS

1 3,000 ohms 3W. (or 1,000 for 90 volts).
1 7,500 ohms 5W. (or 9,000 for 90 volts).
2 5 ohm 5W.

MISCELLANEOUS

2 3 tag terminal strips.
1 4 tag terminal strip.
1 5 tag terminal strip.
5 ⅜ Grommets.
Several lengths of multicolored hook up wire.
1 Threaded mounting pillar.
Piece of 20 gauge brass for battery clip.
Length of 2 core flex.
1 3 pin plug.
Nuts and bolts.
1 950 cell.

acos

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE

DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

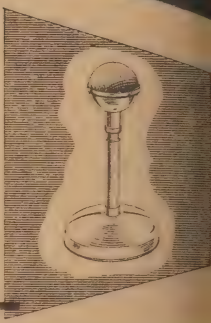
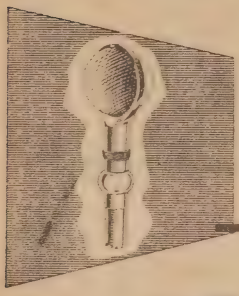


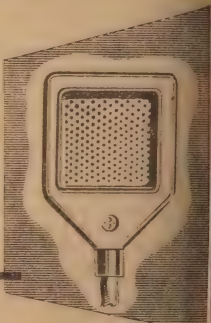
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



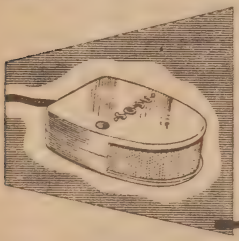
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



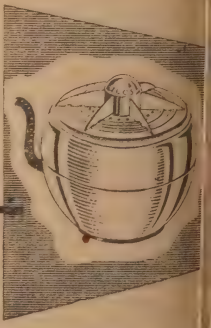
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**



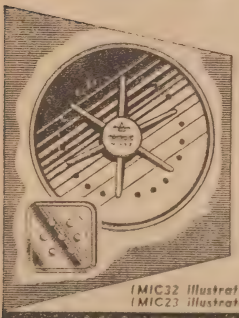
GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc Housed in an attractive die-cast case, it features a high sensitivity and substantially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as ⅛ in. square to 1-⅛ in. round, with various thicknesses from ⅛ in. to ⅜ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

(MIC32 illustrated)
(MIC23 illustrated)

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 88 Parramatta Road Camperdown, Sydney, N.S.W. Phone LA 6124.

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

Though we devoted several pages to it, last month's article on Speaker Baffling Methods had to come to a rather summary conclusion through lack of space. This month we round it off with additional material on vented enclosures, some remarks about other types and about the listening room itself.

☆

PART TWO

Continued from last issue

ON the data and curves on page 95 of the last issue, readers should been able to work out the optivolume and suitable proportions n enclosure to suit their own rements. Doubtless many have done n the meantime, either as an origexercise or to check on a design other sources.

sults in this latter case may not s have proved very conclusive, o differences in dimensions. There be various reasons for this.

e most obvious are simply due to ent ideas about what constitutes est proportions for an enclosure he best relative placement of speakitout and vent. As often as not,

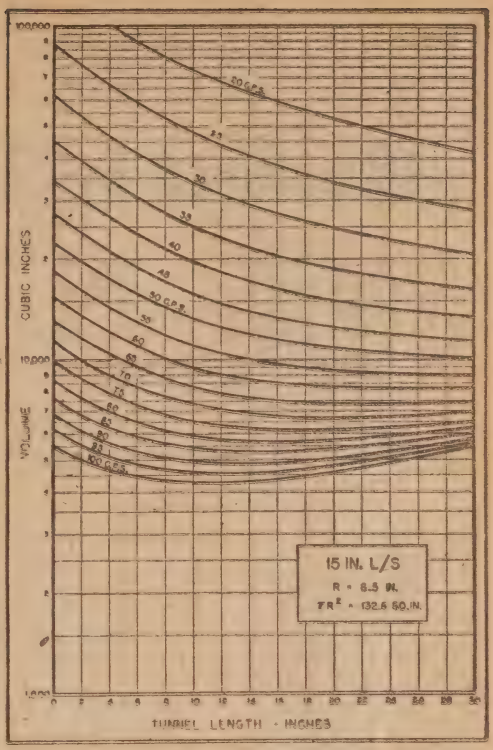


Figure 9: Design curves for a vented enclosure to suit a 15 inch loudspeaker. These are similar to the curves published last month for 10 inch and 12 inch loudspeakers and relate enclosure volume, tunnel length and cone resonance. In calculating volume, allowance must be made for internal braces, the tunnel and the speaker. Allowance need not be made for the padding unless it is extremely thick and dense.

PEAKER BAFFLING PROBLEMS

preferences are based on appearrather than performance.

ain, one author may have pret a large enclosure with a plain another a small enclosure with a hroat, while still others have chosen tionship in between these two exs.

ferent allowances could well have made for space occupied by interruts and bracing, by padding and e volume of the speaker itself.

h differences can markedly affect swer derived from the same basic as. Further discrepancy can arise, er, from the simplified formulas "rules-of-thumb" which have ed from time to time.

E DISCREPANCIES

all, the constructor must be pre- for some discrepancy in design different sources and, if the dewere highly critical, such discrepmight be the source of much mis-

wever, as we pointed out last h, modern practice normally dic- that the enclosure be heavily ed to complement the characterof the speaker and digression from eoretical optimum is not a very s matter in practice.

curves reproduced last month and originated by J. A. Youngmark, of Goodmans Industries Ltd., present the basic data in a readily useable form. By way of additional information, we reprint as figure 9, the data for 15-inch loudspeakers. Such speakers are normally used as woofers only, but naturally require proper baffling in this service.

If other published data appears to call for an enclosure volume and/or throat length appreciably smaller than the various curves indicate it should be, treat it with some caution.

"BIGGER THE BETTER"

On the other hand, if volume and/or throat length is substantially greater than would seem to be required, there is reason to believe that the designer has deliberately deferred to the "bigger-the-better" approach mentioned last month.

You may prefer to follow suit or to reduce the volume to the minimum indicated value, to conserve space in the listening room.

As an alternative to the conventional rectangular enclosure, one may be built to a triangular floor plan, as illustrated in figure 10.

Suggested by Youngmark, in his original articles, this enclosure has an effective volume of about 8000 cubic inches. It is designed for use with a 12-inch loudspeaker, having a cone resonance of 55 cps.

The specifications state that it should be built from 1-inch timber and lined with soft felt 1-inch thick.

For speakers having a lower cone resonance, the dimensions would have to be increased to give the necessary additional volume and/or throat length.

An enclosure of triangular shape allows it to fit conveniently into one corner of the usually rectangular listening room.

Besides being a convenient arrangement, it is an acoustically beneficial one. A low frequencies, the wavefront produced by the speaker and vent engages the floor and walls and is further developed thereby.

HIGH FREQUENCY OUTPUT

At the same time standing waves are minimised because sound energy strikes the walls predominantly at an oblique angle.

At high frequencies, the output from the cone is better dispersed over the listening area, since no listener can be more than about 45 degrees from the axis of the speaker.

Finally, within the enclosure itself, the reduction in area of the parallel surfaces must reduce the standing wave problems and, with it, spurious loading effects on the cone.

Threatened by Sharks — and Water

Working underwater — even in small rivers and creeks — P.M.G. cable-layers frequently meet sudden dangers.

In Queensland's tidal creeks, marauding sharks are often a menace to the men as they work across the creek bed.

So an electrified fence, charged from terminals on either bank, has been devised to form a barrier on both sides of the 6 ft. deep cable trench.

While these shark-proof fences allow the cable-layers to carry on their jobs safely, the cables themselves demand protection against damage from water.

Here, SHELL scientists have helped by developing from petroleum a new resin*, now regarded as the most effective water-proofing agent yet discovered.

It is used extensively in the manufacture of communications equipment, and is yet another example of Shell working alongside technicians and experts in other fields to speed business and boost the nation's economy.

286/D

**Epikote resin*

he structural requirements for a vent-nclosure have been mentioned pre-ly and scarcely need further em-s.

e body of the enclosure must be and it is generally suggested that ing less than 1-inch thick timber be plywood being an excellent medium use it is less likely to leave cracks to shrinkage and warping.

aces should be glued and screwed wise across any large surface which ely to produce "drumming" effects. e removable back or side panel (for s to the speaker) must be securely ved in position and great care taken e that rattles and buzzes cannot be rated by the considerable intensities h are built up inside the enclosure.

FACE PADDING

e internal surfaces should be free-added with thick underfelt or other y absorbent material.

is usually necessary to cover the of the enclosure with some type of c, for the sake of appearance, and partial protection for the cone st prying fingers.

eavy furnishing fabrics must not be in front of the speaker because of bsorption effects on high frequency it. The cloth needs to be light in re, and of an open weave, some of woven plastic cloths being an excel-choice.

and large, a cloth which is open e light and not too heavy, will be parent acoustically.

oth across the vent is not so criti-because high frequency radiation is nvolved. At the low end, a certain nt of damping across the vent is to be beneficial in practice rather otherwise.

this connection, in his book "Hi-Fi speakers and Enclosures", A. B. n describes procedures which can lopted for adjusting both the reson-of the speaker system as a whole. ts damping.

justment of resonance requires a ntional multimeter and access to a ple frequency audio generator cov-the bass end of the range.

AKER RESONANCE

st step is to measure and note esonance of the speaker cone in air. This is best done by feeding peaker from an amplifier, but with istor in series with one voice coil qual to about five times the nomi-pice coil impedance.

sence of the resistor in circuit al-the voltage across the speaker voice o vary with changes in voice coil lance.

setting the multimeter to its low-C range, and connecting it across ice coil, variations in output volt-n be read off as the frequency is over the region of bass resonance. dequate meter readings c not be ed directly without danger of am-overload, it may be necessary to ose some kind of an amplifier stage as a meter amplifier. Naturally h, the stage must be substantially over the range in question, so as confuse the end result.

en the speaker under test passes gh resonance, the voltage across ice coil will normally show a dis-trise, the order of the rise being ined partly by the value of iso-n resistor used. (The larger the re-the more obvious will be the

By plotting a simple graph of voltage against frequency, the position and amplitude of the impedance curve can be recorded.

When the speaker is mounted in its enclosure, the impedance curve should show some reaction, being shifted up or down or "notched" according to the relationship of enclosure to speaker resonance.

By partly covering the port, or adding to the throat, it should be possible to achieve an impedance curve which resembles the curve shown in figure 5 of the September issue (page 91).

After having tuned the system to resonance, Cohen suggests that its "Q" can be adjusted using nothing more than a single 1.5-volt torch cell.

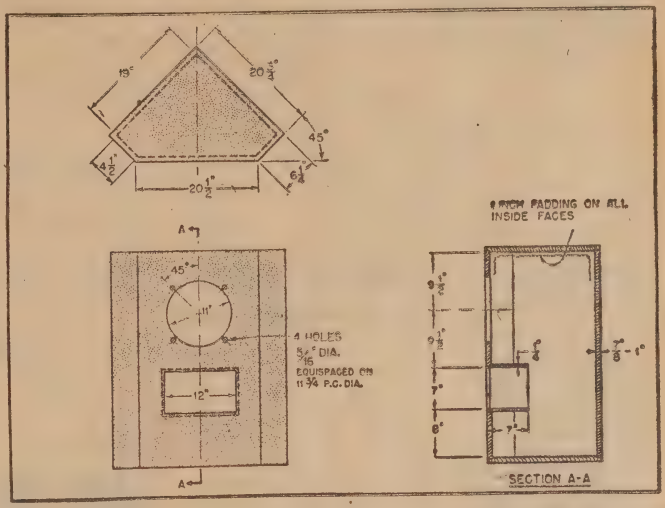


Figure 10: Details of a typical corner-type vented enclosure designed by Goodmans Industries for a 12 inch loudspeaker. With a tunnel as shown the enclosure will match a 55-cycle cone resonance. Omitting the tunnel raises the resonance to suit 75 cycle cones.

By taking leads from the voice coil to the cell and alternatively making and breaking the connection, a series of pulses can be imparted to the cone.

With nothing across the vent and the damping therefore at a minimum, the impulses on make-and-break may be reproduced as a "bong", due to the system being shocked into oscillation at its resonant frequency.

By placing a piece of light, tightly-stretched cloth across the vent, some modification of the resonant "bong" may be observed. Cohen suggests that the optimum condition obtains when the restriction on the vent is just sufficient to reduce the noise, first on make, then on break, to a "click" rather than the "bong" previously mentioned.

NOT ESSENTIAL

While such experiments are doubtless interesting and fruitful, to a degree, they are not by any means essential to the satisfactory operation of a vented enclosure.

Experience indicates that, if an enclosure is built in the correct fashion and to accepted specifications, performance is generally satisfactory and a vast improvement over more elementary methods of baffling.

One or two modifications to basic enclosure design have been suggested by technical writers. One is to stretch a cloth membrane across the centre of the enclosure, between the speaker and the vent. Aim of this is to increase the overall damping of the system.

Another treatment is to place an inclined, padded shelf across the inside front of the enclosure with a view to increasing the path length between the rear of the cone and the vent. The shelf does not affect the basic function of the enclosure, but it does break up internal reflections better and minimises pressure leakage between front and rear of the cone at critical frequencies in the lower middle register.

Recently, Goodmans Industries have developed an "acoustic resistance" unit, designed to be fitted into the vent of a suitably designed enclosure. To the time of writing we have not had the opportunity of testing this unit in an enclosure of the recommended design.

Experiments have also been conducted overseas with acoustic resistance units, fabricated in various ways and intended to be mounted in the vent area.

Last, but not least, mention should be made of vented enclosures made up from sand-filled panels or even brick. Such enclosures, though too cumbersome for most domestic scenes, are capable of extremely good bass performance by reason of their mass and freedom from incidental panel-resonance effects.

ENCLOSURE SIZE

So much for the vented enclosure, at least, of the conventional type. Objection is sometimes raised to such an enclosure on the score that it really constitutes another piece of furniture, for which there may not be space in the listening room. Can it be reduced in size?

The answer, broadly, is no, unless performance is to be degraded markedly. The performance may still be good enough and still represent an improvement over prior arrangements, but it is not likely to be optimum.

It follows, of course, that space re-

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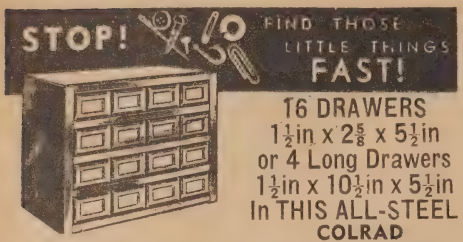

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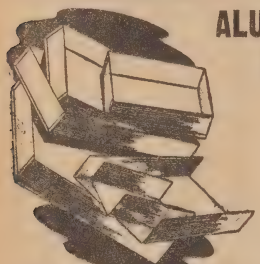

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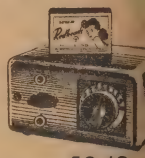

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uirements can be reduced by choosing eliberately a smaller speaker and/or one aving a higher cone resonant frequency. nder these conditions, the enclosure an then be made to behave as per figure (last month), except that the resonant henomena and the low-frequency cut-off ill occur higher up in the spectrum.

This may not appear at first as a very ttractive proposition, but it can still epresent a vast improvement over what ne could expect from a perhaps even naller speaker which has been mounted itherto in a mantel cabinet.

Behind this statement lies the enthusism which is sometimes exhibited by olk who have built up small cupboardyle vented enclosures to match and to ouse inexpensive 6-inch or 8-inch peakers, operating from a modest amplier or mantel set.

HE R-J ENCLOSURE

A serious attempt to solve the space roblem without such sacrifice in perormance is represented by the so-called -J enclosure. Details appeared first in udio Engineering for January, 1953, eing reprinted in our May, 1953, issue.

Like the vented enclosure, the R-J is erived from the Helmholtz resonator. is a box of essentially smaller dimenons than the usual vented enclosure, e geometry being arranged so that oth speaker and vent radiate through e one orifice.

Details of a typical R-J enclosure are ven in figure 11, the dimensions being aimed by the author to be generally itable for either 12-inch or 15-inch eakers, with cone resonance figures ithin the 40-70 cycle region.

Acoustic resonance occurs between e air within the enclosure id that within the frontal nt, the narrow passage between the ffle and box front providing a preominantly resistive component, which n be manipulated to obtain optimum mping of the system as a whole.

The intention is that the baffle should supported clear of the box front on ur stout bolts, in such a way that tating the bolts will allow the baffle vary in distance from the front of e enclosure by anything from just der an inch to, say, one-eighth of an ch.

MPEDANCE CHECK

The speaker should be set up in the closure and the impedance characteric checked by the method described rlier, until the flattest possible impedce curve is obtained over the bass reter. A typical curve quoted by the thors is given in figure 12.

If facilities for checking impedance not available, the constructor's only parent resource would be to set the acing at what appears to give the best sults.

The natural resonance for the enclo e shown in figure 11 is quoted by authors at about 84cps, which is iberately above that of the speaker ely to be used in it.

The R-J enclosure must be built from ut timber, though the smaller panel as are less demanding of support than se in a conventional vented enclosure. must be freely padded internally, to vent reflections and standing waves at ddle and high frequencies.

The cutout in the baffle proper should respond, as usual, with the pad ring the selected speaker.

f the enclosure is to be used as a oofer exclusively, a rectangular slot (as illustrated) is perfectly satisfactory, and adequate performance would be obtained from the lowest frequency up to 400 or 500 cps.

However, according to the originators, if the enclosure is to be used for a wide-range speaker, then the frontal opening must be modified.

While the shape of the opening must be determined specifically for each individual cabinet type, it may be described roughly as resembling a "skinny lemon".

It may be approximated by laying out a diamond-shaped opening with its major axis about 25 degrees from the vertical and with its minor axis at an angle of approximately 15 deg. from the horizontal.

The minor axis should be one-half the length of the major axis, and the total area be calculated to equal the active area of the cone.

Then, after the diamond shape is laid out round off the obtuse corners, and extend the acute corners. Here we quote the original text:

"Since the object is to resonate the enclosure somewhat above the cone resonance, and since the volume and the size of the frontal opening determine the resonant frequency, it is readily possible to design a satisfactory cabinet for speakers smaller than the 12in or 15in models.

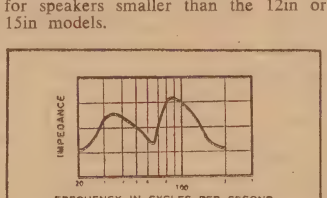

Figure 12: An impedance curve for a typical R-J enclosure, as quoted by the authors of the design. They suggest that the enclosure be resonated above the cone resonant frequency, thus producing the two humps shown.

"This has been shown by the performance of the 8in enclosure, which is 23½in long, 11 high and 10in deep. The design of this cabinet is the same as for the larger one, being modified only by the differences in size and resonant frequencies."

Since its release, the R-J design has been responsible for as many arguments as any enclosure ever described. Only recently, the author discussed the subject with an engineer who had been commissioned to investigate enclosures generally for one of the big local radio firms.

He asserted most definitely that the R-J was the "pick of the bunch", being smaller, flatter and better than any enclosure tested.

A few days after, a second engineer, with no less experience or facilities, said that he had experimented extensively with the R-J and found it extremely critical in adjustment. Further, that he had never once succeeded in duplicating the conditions which the originators claimed should be capable of achievement.

Our own experience with the R-J enclosure, though rather limited, indicates that a fair assessment of its performance lies midway between these two extremes.

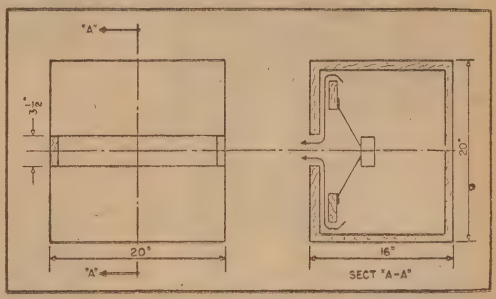

Figure 11: Details of the R-J enclosure, as given by the originators of the design. The enclosure as shown is claimed to suit either a 12 inch or a 15 inch speaker the distance between baffle and front being adjusted experimentally to achieve optimum damping.

With typical wide-range speakers in the enclosure, two distinct impedance peaks were immediately obvious, one just under 80 cps and the other just under 40 cps. The position and magnitude of the peaks were influenced to some degree by the spacing of the baffle from the enclosure but not to the extent that one might expect.

Listening tests indicated that there was no direct tie-up between the impedance curve and acoustic output, so that we found ourselves adjusting the gap more for the latter than the former.

Taking the experience with one speaker as an example, with the gap open to nearly one inch, the response from 200 cps down to about 100 cps appeared to be quite lumpy, with sharp peaks and troughs through the range. There was a serious output peak at 87 cps, an almost complete null att 60 cps and a partial recovery of output at about 50 cps.

Reducing the spacing to ¾in produced noticeable peaks in the region of 170, 120 and 78 cps, a near null at 60 cps, a partial recovery 50 and a falling away thereafter.

At ½in spacing, we recorded a peak at 170, a hole extending from 165-140, and lesser peaks at 120, 105 and 52 cps.

BEST RESULTS

Best results were obtained with the gap closed up to just under a quarter inch. This spacing eliminated the peaks and troughs in the region 200 cps to 80 cps, produced a prominence at 70, a trough at 60 and a partial recovery towards 50 cps. Accoustic output below this was sharply reduced, even though the cone was moving freely. At 25 cps frequency doubling commenced quite suddenly.

Indications seemed to be that useful output could be obtained from the system to just below 50 cps but there was little encouragement to think that sustained response could be expected much below this figure.

On a listening test, with the enclosure behaving as described, the bass response

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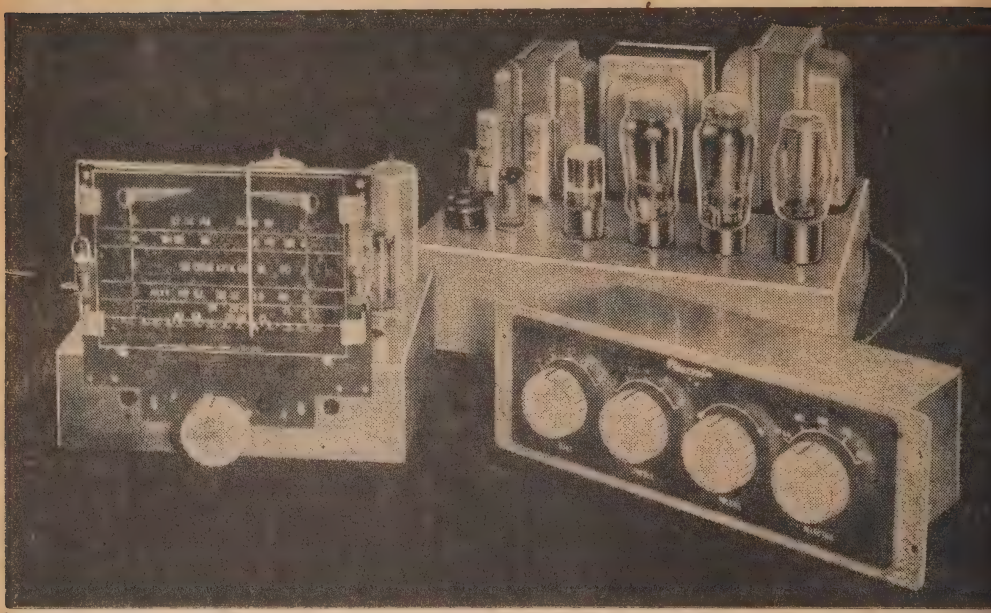

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ounded quite full and out of proportion
o what one would normally expect from
n enclosure of such modest dimensions.

Unfortunately, replacing the speaker
ith another type, leaving everything
se the same, produced less satisfying
esults, both on generator tests and
usical reproduction. The need for
rther experiment was indicated, either
baffle position or in interior damp-
g.

AIN LIMITATION

This does appear to be a limitation in
e R-J in that, despite the authors'
aims, it is sensitive to the type of spea-
er used and to enclosure adjustment.
his could, in fact, account for some of
e widely divergent opinions which are
xpressed about its performance.

A further point which impressed was
e fact that the speaker is so low down,
ith the enclosure resting on the floor,
at propagation of the higher frequen-
es is seriously impaired. Tilting the
closure can correct this to a degree
t produced a rather noticeable beam
fect.

The circumstance rather suggests that
e R-J could well serve as a small
using for a middle and bass speaker,
pplemented by a high frequency unit
erating in a more advantageous posi-
on.

All told, our present reaction to the
-J is that it is a useful design for situ-
ions where enclosure volume has to
kept to an absolute minimum. How-
er, because of its critical nature and
limited performance in the extreme
ss register, it is not as good a pro-
sition as a properly designed vented
closure.

The latter is therefore to be prefer-
d where it can possibly be accommo-
ted.

Thus far, mention has been made of
veral basic methods of baffling the
udspeaker, including flat baffles, sealed
xes, folded horns, labyrinth systems
d vented enclosures, including the
J.

Over and above these basic methods
gineers and enthusiasts have evolved
seemingly endless array of enclosures,
asting a seemingly endless array of
mes. By and large, it is extremely
fficult to assess their likely perform-
ce, either by inspection of the plans
by attempted mathematical analysis.

A check through some of these plans
dicates that, in many cases, they are
combination of systems.

Thus, some enclosures are basically
the vented type, but have the speaker
back from the front panel, radiating
the room through what is virtually
short horn.

FECT OF FLARE

Presumably the major effect of such a
e in front of the speaker would be to
rease acoustic efficiency in the middle
gister, thereby affecting the rather
sterious quality called "presence".

n other cases, a vented enclosure is
lt, but with an internal shelf (see
vious reference) lowered so close to
bottom of the cabinet that it forms
irtual throat, which is wider at the
face of the cabinet than it is intern-
.

his produces an enclosure with what
commonly referred to as a "horn-
bled" vent.

Again, designs have been evolved which put the vent above the speaker, both being mounted on a baffle set back from the front of the cabinet and inclined slightly upwards.

Instead of being acoustically transparent, the front of the cabinet has an inverted "V" cutout, which is intended to modify somewhat the radiation from the vent.

A still further approach is to have a slot-like vent at the rear of the cabinet, discharging into a duct formed by external partitions and radiating the energy forwards into the listening room.

Sometimes the enclosure is independent of its surroundings. In other cases, the intention is that it be located in the corner of a room, so that the horn effect is continued by the walls and floor.

HORN VARIANTS

Distinct from these again are the many enclosures which are variants of the folded horn idea. The speaker is mounted on a flat baffle and radiates directly into the listening room. Sound pressure from the rear of the cone is led around a couple of partitions, providing a horn effect for the lower frequencies.

Recently, we had the opportunity of making a few observations on such an enclosure in an ordinary listening room.

Tested separately, with the aid of an audio generator and a multimeter, the speaker was shown to have a prominent impedance rise at 40 cps—its bass resonant frequency.

When mounted on the horn-type cabinet, the single prominent peak at 40 cps was replaced by a lesser peak at 80 and a further broad peak between 20 and 27 cps. The effect of the enclosure on the impedance curve at least was most marked.

As in the case of the R-J enclosure mentioned earlier the acoustic output, as judged by ear, was only vaguely related to the impedance curve, although this latter was interesting.

HOW IT SOUNDED

Our notes on acoustic output, just as we jotted them down, read as follow:

Audible peak at 165 cps (not prominent).

Audible peak at 120 cps (not prominent).

Prominent peak at 70 cps.

Hole at 50 cps but improving lower down.

Frequency doubling from 27 cps down.

Output peak at 25 cps.

Output drops after 22 cps.

Judged on musical reproduction, there was plenty of low frequency response from the enclosure. It would have delighted some listeners but appealed less to others by reason of the 70-cycle coloration.

These remarks apply, of course, to a particular case and do not signify the performance which can be expected from other such enclosures.

In fact, as we mentioned last month, there are many awkward questions which can be posed about the majority of enclosures.

How effective can a horn be which does not obey the basic laws for such a device?

How will the operation of a vented system be affected by making it discharge into a short horn, a slot or a duct?

What will happen at frequencies which

(Continued on Page 45)

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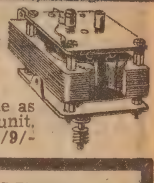

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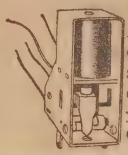

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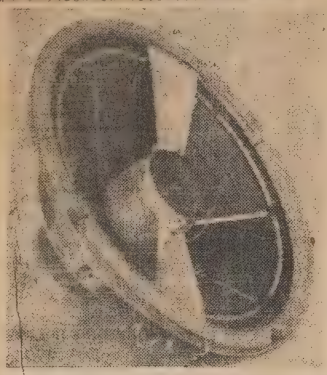

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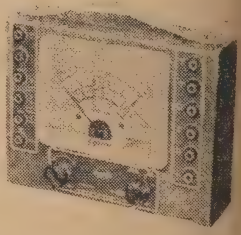

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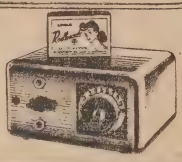

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propagated from both the front and of the cone, out of phase and at ut equal efficiency?

n practice, it would appear that such blems are seldom dealt with on a ely theoretical basis. Rather is there ery large element of try-it-and-see, ereby one effect is balanced against ther until the end result looks right instruments—or merely sounds right he sponsor.

Herein lie certain hazards:

1) The possible critical nature of ensure dimensions.

2) The degree to which results may end on using a certain class of aker.

3) The ability of the sponsor to judge real merits of the design.

FFICULT TASK

All told, it becomes a very difficult to evaluate any given enclosure de- by merely looking at the plans. fortunately, the cost and complexof the enclosures makes it equally ossible to try them out in practice.

The would-be constructor must, there-, rely on reports from acquaintances may have built up a given enclo- on chance. Failing that, it must be ssed on the standing of the person company sponsoring it and on its ign role.

s it an "ultimate" design or is it a mpromise between size and perform-e? Is it intended for use with a aker having a medium or very low e resonance?

s it intriguingly small? If so, how the designer got around certain ic acoustic laws, which make it so icult to reconcile small size with d low frequency response?

The would-be constructor should seek answer to such questions before put- saw to plywood.

ncessions for Amateurs

N September 6 Senator George Hannan asked the following ques- in the Senate Chamber at Canberra: ask the Minister representing the surer in view of the necessity of uraging technical education in elec- ics, both for civil services and as a voir of trained personnel for the nce services, and in view of the fact licensed radio amateurs are filling ge part of the gap in these require- s, will the Minister consider favor- exempting from sales tax all elec- c and radio equipment sold to per- holding radio transmitting or imental licences, provided that such ment is for experimental purposes, that such persons quote their call or special tax number?"

d why not? In the past the Gov- ent has recognised amateurs for urpose of tendering for disposals ment on the same basis as scientific s, and should not now need to be of the services amateurs have given e nation in many emergencies. The in revenue would be completely g, and the amateurs' claim to such cession in indisputable.

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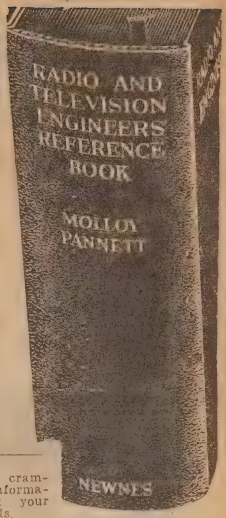

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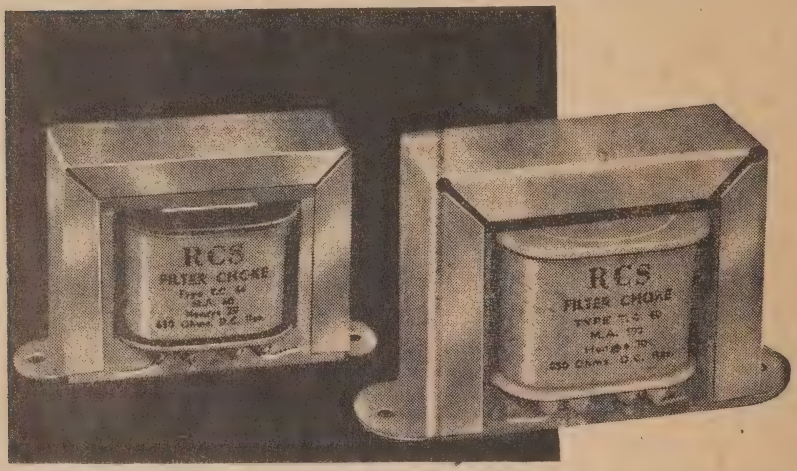

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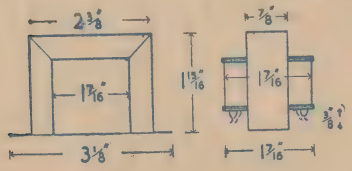

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TC 66 Windings only

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TS 25 P/P Triode	3500	2.3
TS 26 P/P Triode	3500	3.9
TS 27 Single Pentode	5000	2.3
TS 28 Single Pentode	5000	3.9
TS 29 P/P Pentode	5000	2.3
TS 30 P/P Pentode	5000	3.9

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F 133 Single Triode	3500	3.9
F 134 P/P Triode	3500	2.3
F 135 P/P Triode	3500	3.9
F 136 Single Pentode	5000	2.3
F 137 Single Pentode	5000	3.9
F 138 P/P Pentode	5000	2.3
F 139 P/P Pentode	5000	3.9

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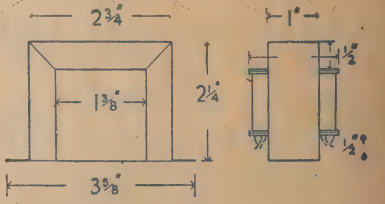

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TC 60 100 M/A 30 H
TCC 70 75 M/A 50 H
TC 65 50 M/A 30 H
TC 58 L/T 3 amp 50 M/H Vib.

AUDIO TRANSFORMERS
TB 42 A Class 3 to 1
TB 43 A Class p/p 3 to 1
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CAR RECEIVER USES NO VIBRATOR UNIT

(Continued from page 27)

nal current, rather than a voltage. accomplish proper driving of the nsistor, a driver stage is used between detector and transistor stage.

This driver utilises a space charge grid ween its cathode and input grid to p accelerate electrons past the control d. This space charge grid is wired to 3-plus" through a resistor so as to be s positive than the plate at all times.

ANSISTOR AMPLIFIER

The power amplifier stage incorporates Motorola type 2N176 p-n-p junction nsistor, wired in a grounded-collector, nmon-emitter circuit.

A bias is applied to the transistor ele- nt, which receives the input signal. this case, since the input signal is in form of an input current, the bias is the form of a bias current.

The latter is the base current flowing ough the transistor and is determined the difference of voltage between the se and emitter electrodes. The voltage the emitter is set by the value of the pply voltage, but the voltage on the se is made variable by means of R23. e base current determines the amount output current that will flow through output transformer, therefore, when- r the base current is varied the out- current will vary in proportion to

PUT CURRENT

The input current is provided by the ondary of the driver transformer and njected into the base circuit. Because is necessary to bias the transistor, re are two paths which the input can e: through the base circuit or through bias network to ground. Any input rent that flows to ground is consid- d a loss. To reduce this possible loss input signal a tertiary winding is pro- ed on the output transformer.

This winding acts as a large choke in bias network and presents a relatively ge impedance to signal currents. The mfd. capacitor from the emitter to secondary of the driver transformer her insures against signal losses.

The gain of the transistor stage is such a 1-milliampere change in base cur- causes an almost 40-milliampere nge in the output current.

USEFUL HINT

ESS experienced constructors may not be sure of what is required of a er joint in electronic equipment and ce how much solder to apply.

Most solder joints in circuits con- ed with valves are merely required make a connection: the current actu- flowing through the joint is but a ll fraction of current carrying capa- Therefore, there is nothing to be ed by covering the joint with as ge a blob of solder as possible. Cer- ly, make sure that both parts of the nection are properly tinned and ed but do not continue applying lder until there is a risk of molten l dropping between socket lugs, &c.

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763	15	5000-3000 ohms P.P	15, 12.5, 8, 3.7 and 2 ohms	P.P. 2A3s or 6AS7s	A or AB1	6/17/3
896	15	10,000-8000 ohms. P.P.	15, 12.5, 8, 3.7 and 2 ohms	P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc.	A or AB1	6/17/3
897	15	10,000-8,000 ohms. P.P.	500, 250, 166 125 and 100 ohms	P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc.	A or AB1	6/17/3
SPECIAL HIGH FIDELITY (plus minus ½ db 20-40,000 c/s)						
872	12	10,000 ohms P.P	3.7 or 15 ohms	P.P. 6L6s, 807s, KT66s, etc.	A (triodes)	8/8/7
SPECIAL HIGH FIDELITY (plus minus 1db 10-50,000 c/s)						
2505-8	12	6000 ohms C.T.	(Designed especially for Mullard 5/10 Amplifier)			8/18/3
ULTRA LINEAR plus minus 1db 10-50,000 c/s)						
949	12	8000 ohms	2, 8 12.5 and 15 ohms	6V6, 6BW6, KT61, EL84, etc.	See R & H. Jan., May, Aug. 1955.	9/7/11
MEDIUM FIDELITY (plus minus 2db 50-12,000 c/s)						
809	15	500 ohms	15, 12.5, 8 3.7 and 2 ohms	Line to voice coil		4/9/9
914	15	5000-3000 ohms. P.P.	500, 250, 166, 125 and 100 ohms	P.P. 2A3s, 6A3s, 6AS7s, etc.	A or AB1	6/4/-
915	15	5000-3000 ohms P.P.	15, 12.5, 8 3.7 and 2 ohms	P.P. 2A3s, 6A3s, 6AS7s, etc.	A or AB1	6/4/-
917	15	10,000-8000 ohms P.P.	500, 250, 166, 125 and 100 ohms	P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc.	A or AB1	6/4/-
918	15	10,000-8000 ohms P.P.	15, 12.5, 8 3.7 and 2 ohms	P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc.	A or AB1	6/4/-
922	25	8000 ohms	500, 250, 166, 125 and 100 ohms	P.P. 6L6s, 807s, KT66s, etc.	AB1	7/7/9
891	35	6600 P.P. ohms	500, 250, 166 125, 100 and 83 ohms	P.P. 6L6s, 807s, KT66s, etc.	AB1	8/3/6
928	5	7000-5000 ohms S.E.	12.5, 8, 3.7 and 2 ohms	6V6s, 6BW6s, KT61s, 6M5s, etc.		3/7/-

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PART FOURTEEN—I.F. AMPLIFIER CHANNELS (CONT.)

Having discussed, last month, the response and bandwidth requirements of I.F. channels, it now remains to see what this involves in the way of components and of circuit design.

by W. N. Williams

AT the outset, it may be as well to point out that the response curves extracted last month are idealised curves and not necessarily those which will be encountered in practical receivers.

In the initial design of such receivers, a definite compromise has to be struck between curve shape on the one hand and, on the other, factors such as expense, complexity, overall gain and ease of alignment. Again, discrepancy can occur during actual production.

Figure 85, from a recent article on "Television Test Instruments", is a response curve of a typical receiver, taken with the aid of a CRO and a frequency modulated oscillator. Its general resemblance to the ideal curve, shown last month as figure 84b, is obvious.

It is evident that there is a slope on what should be a flat top, but this might be capable of correction by further alignment.

Whether or not the width of the response pattern is great enough in terms of frequency is not immediately obvious. It would be necessary to move the marker pip along the curve to verify the position of the sound trap, the extent of the flat top and of the slope on which the picture IF is normally centred.

NARROWER PASS-BAND

Overseas, and particularly in the US, there is a marked tendency to design receivers with a narrower than optimum pass-band in the IF channel.

This makes it possible to achieve the requisite amount of IF gain with fewer valves and/or components and therefore cuts production costs. It also reduces fine detail in the picture, but the contention is that viewers are seldom aware of this, in the face of other limitations in the way of program material, receiver adjustment and viewing conditions.

In the RCA new "Personal" TV receiver, the video pass-band is quoted as 2Mc only. This, presumably, allows high gain to be achieved with a simple IF channel, while still providing all the detail that can usefully be resolved on the small screen.

The relationship between picture detail and bandwidth has already been discussed at some length. That between bandwidth and gain requires further explanation and resort to basic theory.

The solid line in figure 86 illustrates the response of a typical tuned circuit. It will be noted that the response is maximum at the resonant frequency "fo" and that it tapers off to either side, diminishing toward zero at frequencies well removed from resonance.

When such a circuit is tuned to accept a modulated signal, the carrier and the sidebands close to it are transmitted more efficiently than sidebands, which are more widely displaced. This is equivalent to saying that the higher modulation frequencies are attenuated, representing the treble content in an AM sound signal and fine detail in an AM picture signal.

In practice, a certain amount of sideband loss can occur without deterioration being evident in the resultant signal — be it sound or picture.

Because this is so, it has become conventional to accept as "flat" that portion of a curve where the response does not fall below 0.7 times maximum.

Stemming from this is the practice of stating the pass-band of a tuned circuit or a complete system as so many Kc or Mc "between its 3db points".

Thus, in figure 86, if the maximum response is taken as unity, then the 0.7 or 3db points on the solid curve occur at the frequencies f1 and f2. The difference between them, delta f, is the pass-band over which the response can be reckoned as flat for most practical purposes.

Mathematically, the bandwidth in megacycles between the 3db points is given by the expression:

$$\text{BANDWIDTH}\ (\Delta f) = \frac{1}{2\pi RC}$$

where R in ohms is equal to the total resistance shunting the tuned circuit and C is the total capacitance in picofarads shunting the inductor.

From this formula, it is immediately apparent that the bandwidth of a simple tuned circuit is inversely proportional to both shunt capacitance and shunt resistance.

LOW C CIRCUITS

Thus a tuned circuit involving a larger amount of capacitance will have a narrower effective bandwidth than one in which "C" has been reduced to a minimum, assuming the same resonant frequency.

Again, a circuit which is shunted by a low value of parallel resistance, will have a broader response than one which is not so heavily loaded.

This is evident from figure 86, where the response curve (shown dotted) for a low value of shunt resistance, is contrasted with the curve (shown solid) for a high value of shunt resistance.

It is evident that the 3db points on the dotted curve are more widely spaced in terms of frequency than on the solid curve. In other words, the pass-band is wider for a circuit which is characterised by low C and low shunt R, and therefore having a low "Q" factor.

Unfortunately, for our present purpose, the increase in bandwidth is obtained at the expense of response at the resonant frequency. Thus, when the tuned circuit is considered as part of an IF amplifier stage, a deliberate compro-

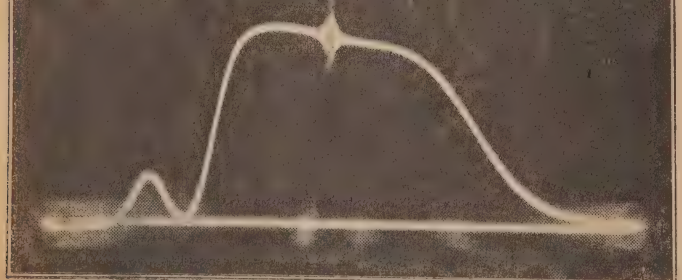

Figure 85: A selectivity curve for a typical television receiver, taken with a CRO and a frequency modulated oscillator (a "wobbulator"). Though taken overall, the curve shape is determined substantially by the IF amplifier. Note the marker pip from the test oscillator, located here centrally on the "flat" position of the curve.

ise has to be struck between bandwidth
d stage gain. See figure 87.
In actual fact, the product of gain
nes bandwidth tends toward a constant
r a given amplifier stage. Thus a stage
ving a gain of 50 times over a band-
idth of 1Mc can also be made to deliver
gain of 10 over a 5Mc pass-band, or
y other combination whose gain-band-
idth product (G x B) is equal to 50.
Since it is essential to provide a wide-
ss-band in a television receiver, gain
ust inevitably be compromised, despite
e best efforts of the designer. His
neral approach to the problem may
summarised as follows:

ARE WITH WIRING

Firstly, because bandwidth increases
"C" is reduced, every effort is nor-
ally made to keep the total capacitance
ross the tuned circuit to as low a fig-
e as possible. Components and wir-
g are selected to give low shunt C and
lves are preferred which combine low
put and output capacitance figures with
her desirable characteristics.
However, it is inevitable that these
ry components will set some minimum
lue for "C", which must be present
ross the inductor. In practice a figure
from 10 to 20pf must be expected,
ade up by the output capacitance of
e valve, the input capacitance of the
xt, and the "strays". (Coils are in-
riably slug-tuned to avoid any further
crease in "C".)
Having thus derived a value of L and
for an IF coil, as dictated by circum-
nces, the band-pass characteristic will
en depend on shunt resistance.
In some cases, sufficient loading may
imposed upon the tuned circuit by the
sociated valve. In other cases an
tual loading resistor may have to be
red across it, perhaps serving at the
ne time as a plate load or a grid re-
n resistor.
With the characteristics of the tuned
cuit thus fixed, the stage gain is then
rely a function of the amplifier valve,
expressed chiefly by its transconduc-
ce.
It follows that the preferred IF ampli-
valves are those which exhibit high
nsconductance along with low input
d output capacitance. It is, in fact,
ssible to derive a "figure of merit"
sed on these rather conflicting quali-
s.
Thus far, we have considered only
at happens in an individual IF stage
olving a single tuned circuit.

NDWIDTH REDUCES

When a series of single-tuned ampli-
stages are resonated to the same
quency (synchronously tuned), the
rall bandpass does not remain equal
that of an individual stage, but is dras-
lly reduced.
The severity of this effect can be gaug-
from a set of hypothetical figures. If
voltage gain of a particular stage at
centre frequency (fo) is 10, then the
n at the 3db points will be 7.07 times
(i. 10 x .707).
Upon amplification by a second iden-
l stage, the gain at fo becomes 10 x
or 100, while the gain at the former
points is now only 7.07 x 7.07,
als 50 times. This is 6db down in
age.
he bandwidth at the new 3db points

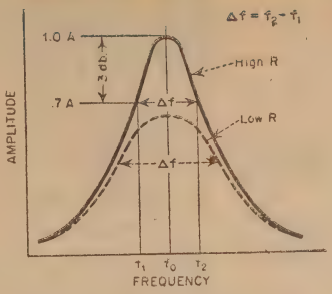

Figure 86: The basic selectivity curve for a single tuned circuit, showing the influence of shunt resistance. For practical purposes, the portion of the curve between the 3db points is normally regarded as "flat".

for two stages will be found to be about 64 per. cent. of that for a single stage.
Further amplification by similar stages synchronously tuned, would result in the overall bandwith being reduced progressively to 51 per. cent. for a third stage, 44 per. cent. for a fourth stage, 39 per. cent. for a fifth stage, and so on.
It becomes apparent that a series of simple, synchronously-tuned couplings cannot meet the requirements of an IF channel in a TV receiver, where an effort is to be made to achieve the optimum band-pass characteristic.
The curve must always have a rounded "nose" rather than a flat top. Furthermore, if individual windings were loaded sufficiently to give sufficient band-pass between the 3db points, the gain would be very low and the slope of the curve outside the 3db points far too gradual.

SHAPE OF CURVE

In practice, the difficulty is often overcome by using a series of single-tuned stages, but resonating the tuned circuits to different frequencies within the desired pass band. This is called "stagger tuning".
The performance of a cascaded stagger-tuned amplifier has been analysed quite exhaustively in technical literature, and reduced by graphs and tables to a fairly straightforward procedure.
From past experience or broad assessment of the position, the designer can nominate the number of IF amplifier stages which he is prepared to use, bearing in mind the type of valves preferred, the overall gain required and the bandwidth. This will give him the number of tuned circuits available to form the stagger-tuned group.
From the data and graphs previously mentioned, he can then determine a suitable bandwidth for each of the tuned circuits and the frequency to which it should be resonated — this to give something approaching a flat-topped, overall selectivity curve.
These data can then be mated with the parent circuit and the individual coupling coils allocated to points in the IF system where the capacitance present and the resistive loading is of a convenient order.
The gain and bandwidth can then be verified accurately and any necessary adjustments made.
Allowance can also be made for the effect on the overall curve of any additional absorption or "trap" circuits which may be necessary further to shape the response.

TYPICAL AMPLIFIER

By way of example, figure 88 shows the circuit details of a picture IF amplifier, suggested by the Philips organisation as being suitable for use in Australian receivers.
Coupling to the front-end tuner is by means of a low impedance link so that there are four circuits available in the IF channel for stagger tuning. These provide what is commonly called a "staggered quadruple".
According to the published data, this amplifier was designed basically to have a nominal centre frequency of 33.5Mc with 3db points at 31 and 36Mc.
Calculation from design data, to satisfy the above requirement, gives the following figures for resonant frequency and bandwidth for the circuits which form the quadruple:

(a) 31.19Mc, 1.19Mc.
(b) 32.54Mc, 4.62Mc.
(c) 34.46Mc, 4.62Mc.
(d) 35.81Mc, 1.91Mc.

Circuits (b) and (c) must exhibit wide bandwidth and are therefore best located at points where circuit loading is heavy. One such point is feeding the diode detector and circuit (c), being also close to the vision carrier resultant, is the natural choice for this position.

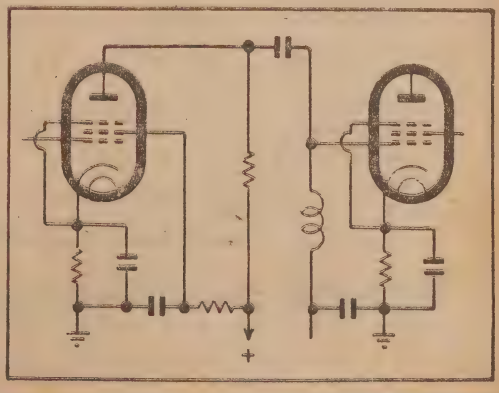

Figure 87: The essential circuit of a single-tuned IF amplifier stage. The inductor is normally peaked with the aid of a slug, resonating at the required frequency with the total valve and circuit capacitances. Variable capacitance peaking would necessarily involve extra capacitance.

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CIRCUIT DIAGRAM OF A TYPICAL PICTURE IF CHANNEL

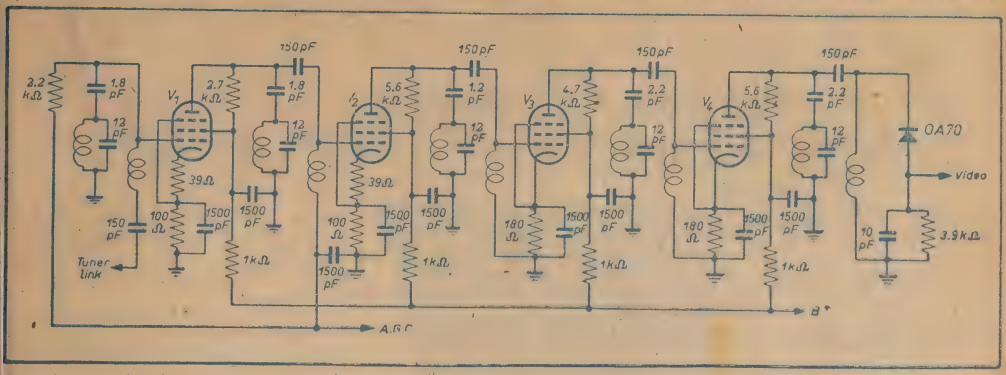

Figure 88: Taken from application data on the 6BX6 tube, this is a typical circuit for a four-stage staggered-tuned picture IF amplifier. Note the trap circuits, which reduce the response of the channel to frequencies outside the intended pass band.

Circuit (b) can conveniently be placed the input to V2, where it can be unt-loaded by a resistor of some 2000 3000 ohms (not shown), sufficient increase its bandwidth to the required gure.

There is a particular reason for plac- this second broad-band circuit at e grid of V2. This valve is subject automatic gain control and changes valve input resistance and capacit- ice with AGC voltage affect the low)" circuit much less than one with higher "Q".

The remaining circuits in the quad- ple must obviously serve V3 and V4. rcuit (d) is allocated to feed V4, since resonance at 35.81Mc is likely to sure a better load condition for high- /el signals in the vicinity of the pic- re IF.

Several other points in the circuit are orthy of special mention, because ey illustrate the modern approach to ture IF channel design.

As a further precaution against a ange in response curve with AGC ltage, a small unbypassed resistor is luded in the cathode circuit of the to controlled valves. The degenerative ect across this resistor entails some all loss in stage gain, but it largely utralises changes in valve input resist- ce and capacitance with grid bias.

The precise value is dependent on lve and circuit conditions, but the ire of 39 ohms quoted is adequate this case.

FECT OF TRAPS

Another interesting feature is the pro- ion of "trap" circuits, which serve modify further the shape of the IF ss-band.

The dotted curve in figure 89 shows natural response of the IF channel, ng the staggered quadruple system as is far discussed. While having the essary flat top, the curve does not pe away sufficently on either side. At- uation at the vision IF is not quite ough, while response at the sound IF far above the requisite 5 to 10 pc.

The additional shaping is provided by p circuits which are disposed oughout the IF channel proper. These capacitively coupled between the re- spective plate circuits and earth, the "Q" factor and the coupling both being significant in the operation of the trap.

According to the published data, a 29Mc trap is coupled to the 32.54Mc circuit at the input to V2. Another trap at 37.5Mc connects to the 35.81Mc circuit feeding V4. These two traps, operating outside the required pass-band, reduce the response to signals from adjacent channels.

The discrimination against interfering signals is further increased by the provision of additional traps at 38Mc and 28.4Mc, in the circuits feeding the diode and V3 respectively.

Finally, a trap system at the input to V1, tuned to 30.6Mc, and operating with those at 29 and 28.4, establishes a plateau on which the sound carrier centres. This plateau should designedly extend for about 100Kc to either side of the sound resultant frequency, so that slope detection of the FM carrier will not occur at the video detector, leading to sound interference with the picture.

NEW FIGURES

Presence of these traps, with their additional shunt loading, affect slightly the calculated figures for resonance and bandwidth of the quadruple. Accordingly, the new figures become:

(a) 31.3Mc. 2.6Mc.
(b) 32.75Mc. 4.6Mc.
(c) 34.2Mc. 4.6Mc.
(d) 35.8Mc. 2.6Mc.

Calculated gain figures for the amplifier are as follow: V1, 9.2 times: V2. 6.95 times; V3, 7.4 times; V4, 14.3 times. This gives an overall figure of 6800, and having respect to the detector resolution, the gain of the video system and picture tube requirements, calls for a modulated input of about 100 microvolts to the grid of V1.

The foregoing should serve to indicate the design which goes into a picture IF channel in order to produce the required result. It should be equally evident that the entire effort, along with the performance of the receiver, can be sacrificed unless the specified alignment procedure is followed.

NOT GUESSWORK

Merely to guess at the stagger frequencies, or the circuits which should be tuned to such frequencies, is to invite confusion in the end result.

If the necessary data are available, alignment of a stagger-tuned IF system is a fairly straight forward process — a factor which has weighed fairly heavily in its favor in overseas receiver designs.

Whether this will be the case locally is a debatable point, because the industry has been launched with fairly fixed ideas as to the equipment which service establishments should have.

It has thus been claimed as an advantage for stagger tuning that alignment can be carried out using an accurate but conventional AM signal generator.

This is simply set at the various specified frequencies and the appropriate coupling or trap circuit adjusted for maximum or minimum response at

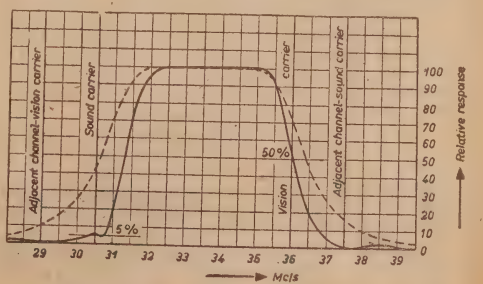

Figure 89: The selectivity curve of the IF amplifier shown above. The dotted curve is for the basic staggered quadruple. The solid curve is for the channel as a whole, taking into account the effect of the trap circuits.

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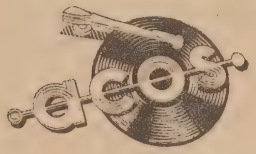

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hat frequency. Assuming that all is n order, the overall curve should then e as intended.

In practice, modern TV service data ssumes the availability, amongst other hings, of a Sweep & Marker Generator, n oscilloscope and a VT Voltmeter.

This equipment allows adjustments to e made, as necessary, to individual rcuits. However, it also allows the verall shape of the pass-band to be ssessed, in case deformation should rise from improper alignment, com-onent failure or the presence of acci-ental feedback.

Having assumed the availability of ich equipment, the possibility of fol-wing an alignment procedure with ss than this is not a very important ctor commercially.

RANSFORMER COUPLING

As an alternative to the stagger-ned IF system, wide use is made of upling transformers having separately ned primary and secondary windings, in conventional broadcast-band re-ivers.

The use of separate plate and grid rcuits confers a number of advan-ges:

(1) The output capacitance of one age and the input capacitance of the xt are not in parallel but appear across parate windings. A higher L/C ratio possible, less resistive damping is re-ired and the higher load presented in nsequence to the valves increases stage in.

(2) Coupling components are elimin-ed from the circuit, further reducing s order of shunt capacitance.

(3) The "Q" factor of the individual ndings can be separately adjusted, ong with their mutual coupling to oduce a natural flat-topped band-ss effect.

Figure 90 will serve to illustrate this int containing, as it does, the basic cuit of a transformer coupled stage, gether with formulas covering band-idth and curves illustrating the effect different degrees of coupling.

When the magnetic coupling between mary and secondary is small, the erall response curve is not unlike that eady illustrated for a single tuned cuit. It is shown dotted in figure 90 d labelled "under-coupled".

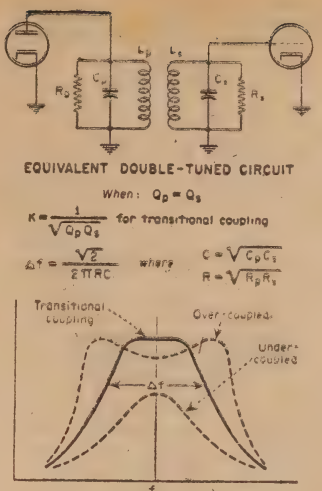

Figure 90: The basic circuit, formulas and curves covering double-tuned IF transformers.

As the degree of coupling is gradually increased, the nose of the curve rises and, with it, the overall gain of the system.

Beyond a certain point, the rise in system gain with increased coupling suddenly tapers off. Instead, the nose of the curve begins to flatten out and widen and the tuning adjustments of the two windings begin to interfere markedly one with the other.

From simply a flat "nose" on the curve, the next step is a definite trough at the nominal resonant frequency, with a pronounced shoulder on either side.

The degree of coupling which just fails to produce a noticeably flat nose on the curve is frequently referred to as "critical coupling".

A transformer which produces a double-humped response is said to be over-coupled while the condition between over- and critical-coupling is referred to as transitional coupling.

For broadcast band superhets, the IF transformers are usually designed with about critical coupling, since this condition provides high gain with high selectivity, yet avoids any serious problem with interaction of primary and secondary tuning adjustments.

Where a wide pass-band is a prerequisite, as in a television receiver, the use of transitional or over-coupling must obviously suggest itself, because it tends toward a response curve having steep sides and a flattened top.

A further advantage is that a number of such circuits can be cascaded with much less effect on the natural overall bandwidth than is the case with simple tuned circuits.

To take an extreme illustration, if the curves were actually rectangular in shape, any number of them could be superimposed without affecting the bandwidth. In practice, of course, the sides of the curves are tapered, so that a certain amount of manipulation is involved to achieve the correct overall response.

As with a stagger-tuned system, the design and performance of over-coupled IF transformers has been the subject of much examination in technical literature and is initially calculable with the aid of graphs and empirical formulas.

TRIAL & ERROR

However, a good deal of practical "pruning" may be necessary because of the difficulty of interpreting coupling accurately in terms of physical distance between windings.

This is further complicated by the modern practice of using magnetic slugs to resonate windings. Screwing the slugs in or out for tuning purposes can have a profound effect on coupling if the slugs have to approach one another too closely.

Finally, the effective coupling is modified by the presence of a capacitive as well as an inductive component.

Because of these problems, the success or otherwise of double-tuned IF transformers depends on very close control during their manufacture and use.

Once the optimum spacing of the coils has been determined, and their position on the former it must be preserved by simultaneous winding on

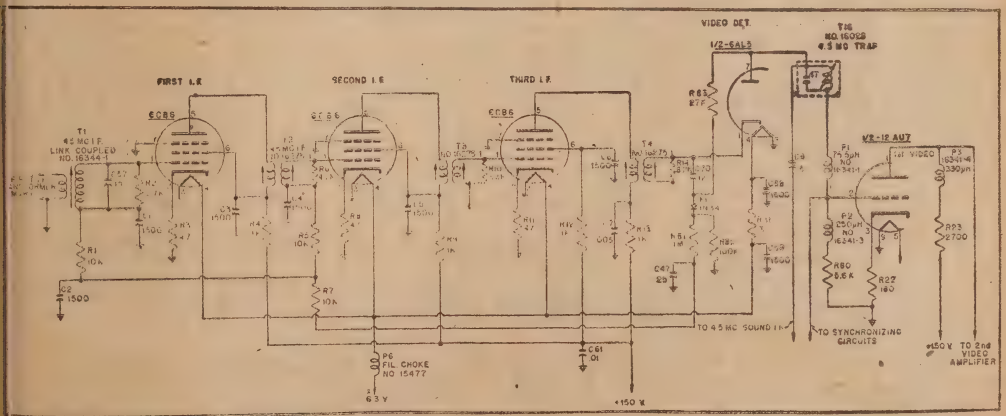

Figure 91: The circuit of a typical American IF strip using double-tuned transformers. At least one comparable pre-aligned IF strip is scheduled for early release by an Australian components manufacturer for home constructed sets.

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accurate machines. Assembly methods must be strictly standardised in respect to the shield can and lugs.

No less important is its connection into the complete IF system. Random wiring methods and component placement can materially affect the shunt reactance and necessitate setting the tuning slugs in extreme and unsatisfactory positions.

The pass-band can also be affected seriously by additional unwanted capacitance coupling between successive stages, or by coupling which leads to feedback effects around several stages. The input lead is quite critical in this respect, since the distance between the first IF amplifier and the frequency changer is often difficult to forsee.

The modern practice of using a low impedance link in this position has obvious advantages, because it is less prone to external influence.

REASONABLE COST

Provided these various problems can be anticipated in a design, the cost of producing double-tuned IF transformers may not be substantially greater than single windings, particularly when these latter have to be supplemented with trap circuits to achieve the necessary attenuation characteristics to adjacent channels.

It may even be that the increased gain from double-tuned transformers may permit a reduction in the number of IF stages in certain cases and a clear saving in the overall cost of a receiver.

By way of example, the designer of the stagger-tuned IF system shown in figure 88 has this to say:

"As an alternative to the above design, three stages band-pass coupled with only one trap (for the sound carrier plateau) might be considered. Such a group has a gain of about 2000 times" . . . (compared with 6800 for four-stage stagger-tuned).

"The overall sensitivity with a tuner gain of 40 would therefore be about 6 microvolts. This is well worth consideration if the added production difficulties caused by the use of band-pass transformers can be tolerated."

TYPICAL CIRCUIT

Figure 91 shows the circuit of an IF amplifier, reprinted from an Auriema, Inc Bulletin and using double-tuned IF transformers manufactured in the United States by the F. W. Sickles Co.

The amplifier is marketed as a complete strip, so that wiring likely to affect the performance of the amplifier need not—and should not—be touched.

Indications are that complete IF strips will ultimately be released by Australian components manufacturers. These, too, will be supplied as a unit, complete with valves and pre-aligned. It should only be necessary to mount them in the main chassis, and provide input, output and supply connections.

Because figure 91 is of American origin, the frequencies referred to follow American practice—44 Mc. approx. for the IF and 4.5 Mc for the inter-carrier beat. Otherwise, the circuit can be regarded as typical.

Regarding alignment, the manufacturers point out that double-tuned transformers present more problems than stagger-tuning and that a variety of approaches have been evolved by different receiver manufacturers. Their own instructions, again quoted for the purpose of illustration, read as follow:

"Starting at the last IF stage, the transformer is tuned so that the response is symmetrical around a centre frequency of 44 Mc. Each successive stage is tuned in the same way, so that the response is symmetrical around 44 Mc.

"This procedure is continued until the first IF transformer is reached. One of the windings of this transformer is artificially loaded and has a low Q tuning. The high Q winding has the effect of shifting the entire response in frequency, without changing the shape appreciably.

"The high Q winding is then tuned so that the picture carrier is at 50% of the maximum amplitude.

"This step is absolutely necessary, so that the IF response will match the characteristic of the transmitted signal.

"Tuning the low Q winding has the effect of tilting the response, without shifting it in frequency. This winding is adjusted so that the top of the response curve is level. When this final adjustment is made, the alignment is complete.

"If the transformers have been properly made, and the channel assembled correctly, the sound carrier will fall at the right position on the low frequency slope of the response curve.

"For this alignment procedure to be practical in production, it is obvious that the IF transformers must be uniform.

MARKER PIPS

"The markers on the sweep used for this method should be placed so that the operator can easily obtain a symmetrical response. When high volume production is needed, at least five markers are used: one at 45.75 Mc (picture carrier); one at 45.25 Mc (opposite picture carrier); one at 43.0 Mc and one at 45 Mc (these to assist the operator in in getting symmetrical response).

"The marker opposite the picture carrier allows a quick check of the bandwith at the 50% point. For the markers listed above, this would be 3.5 Mc, with the response centred at 44 Mc. Different values can be chosen, depending on the response curve that is being measured.

"The marker at the sound carrier

(Continued on Page 127)

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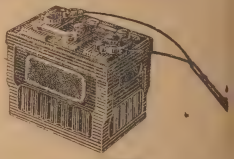

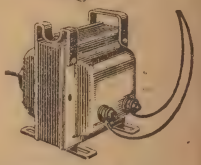

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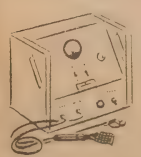

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ABOUT FERRORESONANT CIRCUITS

Continued research into magnetic phenomena has produced a variety of "valveless" circuits which are important because of their ability to operate virtually indefinitely without maintenance. The operation of some of these circuits is discussed in this paper by Aerovox.

If a saturable reactor is made the inductive element of a tuned circuit, either series-resonant or parallel-resonant, varying the current through the reactor will vary the resonant frequency of the combination.

This is the simple basis of all **ferroresonant** circuits.

The most efficient manifestation of this effect occurs when a large resonant frequency shift is obtained as the result of a small change in control current, usually through a separate winding.

VARIOUS USES

The ferroresonant effect may be utilised in various ways in electronic and electrical equipment.

Ferroresonant circuits recently have been designed to perform as amplifiers, triggers, switches, flip-flops, gates and oscillators.

Ferroresonant elements find application in electronic counters, computers and other digital devices, frequency dividers, signal amplifiers and automatic control circuits.

Closely related to the magnetic amplifier, the ferroresonant circuit is tubeless and has unlimited life.

Ferroresonant elements are rugged and can be made extremely small in size. Unlike the magnetic amplifier, ferroresonant devices may be operated at high supply-voltage frequencies, enabling high-speed switching performance and high-frequency amplification.

In Figure 1, a coil having a saturable core is connected in series with a conventional capacitor, resistor and continuously variable AC source. This is the basic ferroresonant circuit.

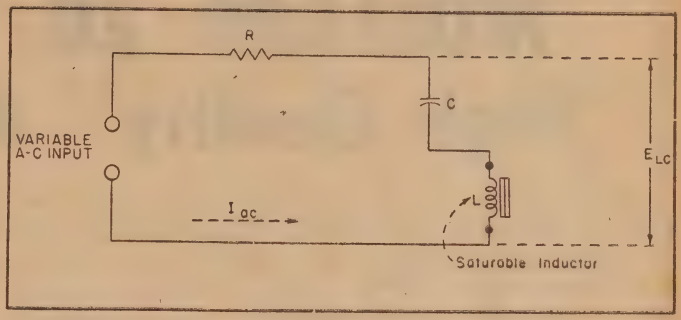

Figure 1—Basic Ferroresonant Circuit.

is increased, the current (IAC) through the coil, capacitor and resistor increases, as shown in Figure 2(B), and the voltage (RLC) across the inductance-capacitance leg increases from zero to a maximum at point A.

As the current is increased beyond this level, voltage ELC would continue to increase except that the core of the coil begins to saturate and this lowers the inductance. Accordingly, the voltage begins to fall after point A.

The decreasing inductance of the coil causes the circuit to approach resonance, the impedance of the LC arm decreasing. The voltage drop ELC accordingly decreases, dropping to point B at resonance.

Although XL equals XC at this point, B does not dip completely to the zero-voltage line because of resistive losses, chiefly in the coil.

As the current is increased beyond this point further saturation of the core and consequent lowering of the inductance tunes the circuit beyond resonance, and voltage ELC again rises, as from B to C.

Figure 2(A) shows the variation of circuit reactance with current. At resonance, the voltage drop IR is due only to resistive losses mainly in the coil copper. Before this point the circuit reactance is inductive and after this point is capacitive.

The plot of Figure 2(B) is seen to have the S-curve shape which is typical of the characteristics of certain bistable and oscillating systems. Thus, the response is characterised by two stable regions of "positive impedance" (OA and BC) connected by an unstable region of "negative impedance" (AB).

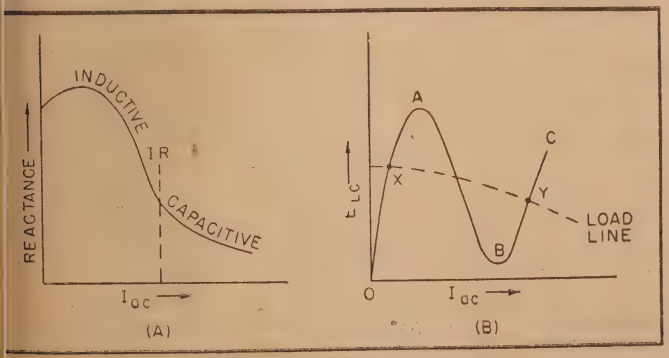

Figure 2—Response Curves of Ferroresonant Circuit

BISTABILITY

This circuit can exhibit true bistability. That is, its current may have either a high or a low discreet value at a particular voltage, and this current value can be maintained indefinitely unless the operator switches it to its second value.

Thus, referring to Figure 2(B), the current might have a low value X or a high value Y along the inscribed non-linear load-line. The current will not hold along the unstable negative slope, AB, but can be made to shift from some point along OA to a point along BC, quickly traversing AB and locking along BC.

If the ferroresonant element is operated in a suitable circuit, conduction may be triggered back and forth between the two stable states. This action suits the ferroresonant element ideally as a binary device.

One of the most promising and already exploited applications of small ferroresonant elements is as flip-flops in digital computers, counters, and frequency dividers.

SECOND WINDING

A second, coupled winding might be added to the simple circuit of Figure 1. This modification is shown in Figure 3. Here, the **control** winding actually consists of two coils (L1 and L2) which are connected series-bucking to isolate the TRIGGER INPUT terminals from the AC supply.

The Zero-current inductance of coil L and the capacitance C are chosen such that the series-resonant frequency, fr, of the combination is somewhat lower than the supply-voltage frequency.

Figure 2 shows the response of this simple circuit. As the supply voltage

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A DC trigger pulse of either polarity applied to the control winding then would reduce momentarily the inductance of L3 and allow the current to jump from X (Figure 2B) to Y.

The current then would latch at the second value and would be unaffected by further pulses applied to the control winding, since the high current at point X would be sufficient to maintain the core saturated.

The fact that the current in this simple circuit cannot be returned to its initial level by alternate pulses but only by a momentary interruption of the AC supply line prevents use of the circuit directly as a flip-flop even though it is bistable.

Figure 4 is an arrangement of two ferroresonant elements in parallel. Each has a separate control coil. This arrangement provides good flip-flop action. The circuit is due to Isborn.

Here, L3C2 and L4C3 correspond to the simple elements shown previously in Figure 1. Capacitor C1 provides a series reactance which is common to both ferroresonant legs.

CONTROL WINDING

The control winding for the left leg consists of coils L1 and L2 connected in series-bucking to prevent transmission of the AC supply energy back to the INPUT 1 terminals.

Similarly, the control winding of the right leg consists of L5 and L6 connected in series-bucking to prevent AC coupling back to the INPUT 2 terminals.

With the proper magnitude of reactance at C1, only one ferroresonant leg can conduct in the high-current state at one time.

If both legs should attempt to operate at this level simultaneously at high current, the increased voltage drop at point X would reduce the leg drops (EL3C2 and EL4C3) below the resonant value and neither one could latch-in at high current.

When both legs drop to low-current conduction (or attempt to do so), the drop across C1 falls and the voltage at point X rises to such a high value that either the left or right leg will "fire".

In order to examine operation of this circuit, assume that the left leg (L3C2) is conducting high and that the right leg (L4C3) is conducting low. Output 1 will be high (TRUE or 1 in binary notation) and output 2 will be low (binary FALSE or 0).

NO EFFECT

A pulse applied to INPUT 1 will have no effect, since the core already is saturated in this leg of the circuit. Coil L4, however, is carrying low current and its core is not saturated.

A pulse applied to INPUT 2 therefore will lower the inductance of L4 saturating the core of this coil and moving the L4C3 leg into resonance.

The high current then will reduce the voltage at point X momentarily to such an extent that L3C2 is detuned from resonance and drops to the low current condition. High conduction then shifts to the right leg and OUTPUT 2 becomes high.

Thus, the two outputs always are of opposite phase and charge states with respect to each other.

For single-input operation, INPUT 1 and INPUT 2 may be connected together and the triggering pulse thus applied simultaneously to L1L2 and L5L6.

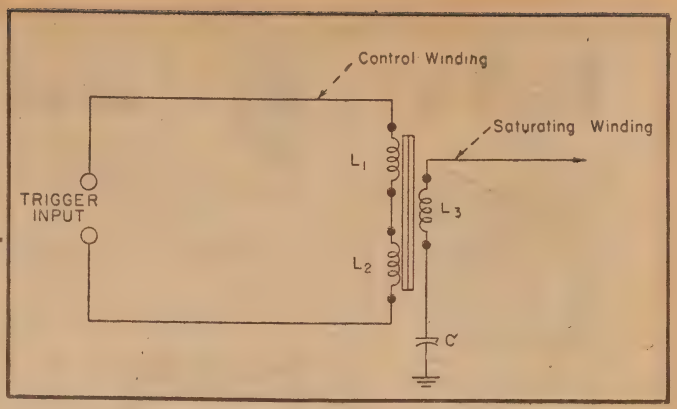

Figure 3—Controlled Ferroresonant Element.

Successive pulses then will cause high conduction to flip back and forth between the two legs and a given pair of OUTPUT terminals will have high output during only half of the number of input pulses. The circuit thus acts as a frequency halver.

Appreciable power gain is obtained. Rutishauser has pointed out that by providing control coils of many turns the required triggering current can be made very small. One flip-flop thus can drive others without intermediate driver stages.

In this way it is comparatively simple to set up tubeless binary counters, ring counters and similar circuits. Rutishauser has had a ring of 32 stages operating satisfactorily and states that about 50 stages would appear to be the upper limit.

Aside from being tubeless, simple and capable of extreme miniaturisation, ferroresonant flip-flops with small cores of thin material may be operated at high power-supply frequencies (1 Mc and higher), allowing rapid switching.

Isborn mentions that the entire switching operation takes place in a period equal to approximately five cycles of the supply frequency.

Another considerable advantage of the ferroresonant flip-flop is its low power requirement. This results from the use of reactive components in the circuit.

LAGGING CURRENT

Futhermore, although high current is shifting from one leg to the other, the load on the power supply is constant. Another advantage is the low heat radiation which results from low power dissipation and the absence of tube filaments.

Triest, of International Business Machines Corp., has patented an improved ferroresonant flip-flop, shown in basic arrangement in Figure 5.

This circuit employs a pair of saturating windings (L2L3 and L4L5) on each core and cross-couples them.

A low, lagging current flows in the less saturated leg and a high, leading current in the more saturated leg. The patent claims that the cross coupling increases the difference between the two

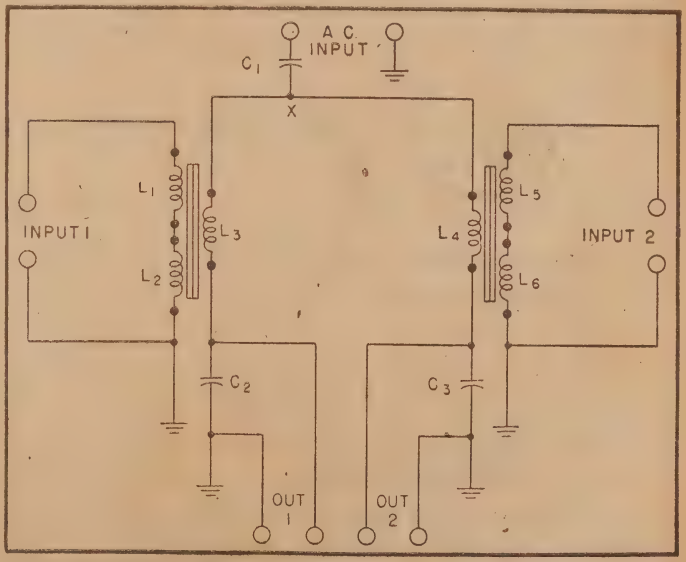

Figure 4—Ferroresonant Flip Flop.

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current magnitudes, creating, in fact, a wide gap.

The common resistance R, in Figure 5, serves the same purpose as the common capacitance C1 in Figure 4.

The main saturable inductor windings are L2 and L4. Coils L3 and L5 are the auxiliary windings. When the left leg is resonant, high leading current in L5 produces flux in the core of the right leg to induce an emf. in L4. This voltage opposes the lagging current in L4.

MACKAY'S CIRCUITS

The net result of this action is a reduction of the current in the right leg and an increase in the current in the left leg. It is in this way that the gap between the values of voltage drop across capacitors C1 and C2 is widened. Outputs are taken from across these two capacitors.

Mackay has developed several interesting circuits of a highly practical nature in which ferroresonant elements are combined with the non-linearity of tungsten lamp filaments to obtain relaxation oscillations and the intermittent operation of lamps 3. This scheme has

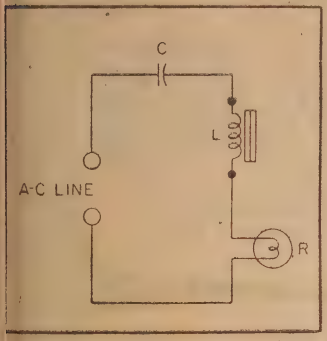

Figure 6—Mackay's Ferroresonant Selanation Oscillator

been described also in the popular literature 5.

Figures 6 and 7 show two of Mackay's circuits. In Figure 6, L is the primary winding of a small filament transformer (Stancor P-6135) and serves well enough as a saturable reactor at the current levels involved. C is a 12-microfarad capacitor (non-electrolytic) and R is a 100-watt lamp.

The latter exhibits low resistance (high current) when its filament is cold and high resistance (low current) when hot. The L and C combination behaves like the simple ferroresonant circuit shown in Figure 1 when the current is high enough to start saturation of the coil L.

The circuit is operated from the 115-volt AC powerline through a variable autotransformer such as Variac.

LAMP FLASHES

When the circuit is switched on the filament is cold and its resistance low. The lamp accordingly lights from the correspondingly high current flow and the ferroresonant circuit operates at its high-current point.

As the filament heats, its resistance increases, the current accordingly drops and will snap (flip-flop fashion) to the low-current point on the ferroresonant response curve. The lamp, therefore, extinguishes.

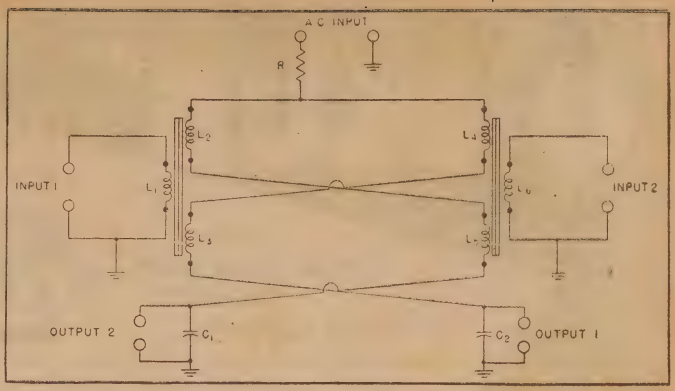

Figure 5—Triest's Improved Flip Flop.

As the filament then cools, its resistance decreases, current again rises and soon snaps back to the high-level point to repeat the cycle of operations. When the input voltage is adjusted to a certain critical point the lamp flashes on and off at a regular rate as the result of this ferroresonant action.

Mackay gives a 5½-second ON rate with the circuit constants shown here.

The circuit shown in Figure 7 will be seen to resemble the ferroresonant flip-flop of Figure 4, minus control (trigger) windings. It consists of two "blinker" circuits of the type just described, with the addition of the common capacitor, C1.

In this circuit L1 and L2 are the primary windings of small filament transformers, as before, and C1 is a 16-microfarad non-electrolytic capacitor. C2 and C3 each are 12 microfarads, also non-electrolytic. Each lamp is of 100-watt size.

Both lamps cannot light simultaneously because the large voltage drop across C1, due to the resulting high current flow, would reduce the voltage across each leg of the circuit to a value much lower than the ferroresonant value and insufficient to light the lamps.

However, one leg always will have enough voltage for the lamp in that leg to glow. When that lamp extinguishes, the one in the other leg ignites. Mackay has operated a number of legs through the common capacitor and observed that the lamps flash cyclically.

An obvious application of this low-frequency type of ferroresonant circuit would be as a high-intensity blinker in such applications as traffic signal beacons, railroad signals, etc., where all moving parts, relay contacts and the like would be eliminated and continuous, unattended operation secured.

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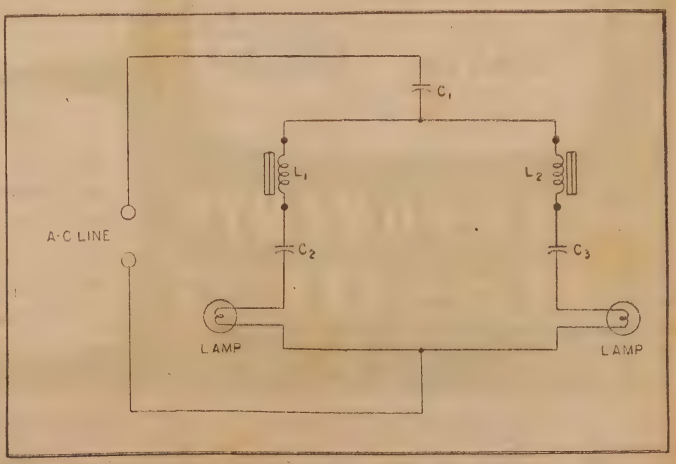

Figure 7—Sequential Flasher.

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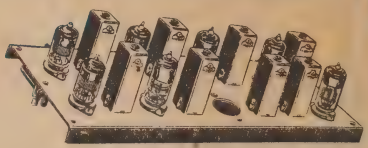

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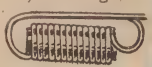

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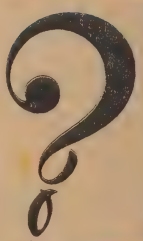

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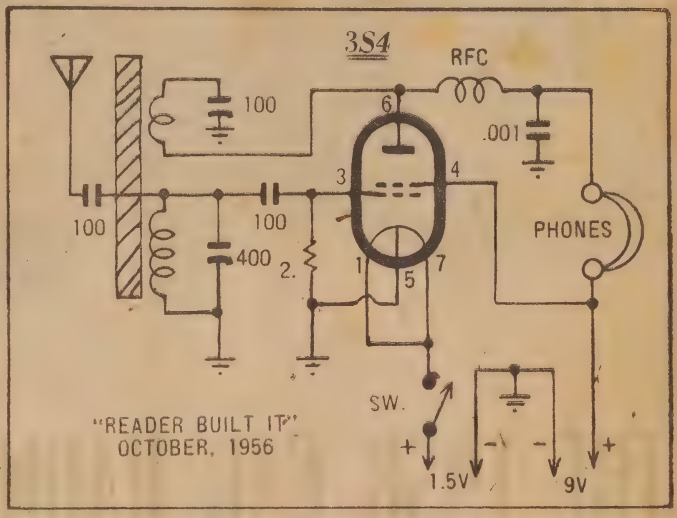


DETAILS of the circuit are given in the accompanying diagram. Immediate point of interest is that the whole set operates successfully from a 9-volt high tension supply, which is a much cheaper proposition than the high tension battery originally specified.

For the tuning circuit a standard loopstick is used, but a reaction winding is added to meet the requirements of the circuit. This comprises 10 turns of wire, wound ¼in from the aerial coil.

Using only 6in of aerial, our correspondent says that all the local stations could be heard from his address at "excessive" strength. All the stations were quite clear of one another and, at night, a few country stations could be tuned at sufficient strength for quiet listening.

With the loopstick mounted diagonally and a 1.5-volt battery on the shallow chassis, the set was small enough to fit into a cabinet 7½ x 4½ x 3½in. (From Master J. Broadbanet, 7 Edgecombe Av., Wahroonga, NSW).

IMPROVING SPEAKER BASS RESPONSE

A READER from Westmead, NSW, who is interested in high quality sound reproduction tells us of his experiments with standard loudspeakers with the object of lowering the natural resonant frequency of the cone and hence smoothing the bass response. The basis of his idea is to substitute chamois leather for the paper edge suspension normally provided and moulded integral with the paper cone. While keeping the effective mass of the cone the same, the softer suspension allows easier movement and lowers the natural resonance.

IMPROVEMENT CLAIMS

Claims of a frequency reduction in the ratio of 2 to 1 have been made but obviously the change would depend on the stiffness of the cone edge before the modifications are made.

There is some element of risk and the speaker distributor may not react favorably if you ask for a replacement after an unsuccessful modification attempt.

However, assuming that you are willing to take the risk the procedure is first to remove the paper board packing which normally contacts with the speaker baffle board. Generally it will come off cleanly without disturbing the cone but if the first tentative attempts to remove it indicate that the cone is not securely cemented to the metal speaker housing, it will be necessary to use a razor blade to effect a separation.

Following this the cone is separated from the housing with a sharp razor blade except for four equally spaced sections each about ½in wide. Cut flush with the cone housing on the larger radius and outside the bead at the edge of the cone proper on the smaller radius leaving a vacant space about 3/8in wide, the last depending on the speaker.

The four pieces ½in wide are temporarily left in place so that the centering of the cone will be maintained.

Then cut from a piece of soft chamois four sections to replace the paper removed and wide enough to allow them to be cemented to both the cone housing and the cone. Depending on the speaker size the chamois pieces could be up to 1in wide.

Do not cut the leather from a large circle but rather from a small piece in such a way that the grain running across each piece is the same. The job may be made easier if a complete ring is drawn up on paper and cut to serve as a template for the pieces. Each will be about ½in shorter than the quarter circle because the ½in strips of original cone will not be covered initially.

RUBBER CEMENT

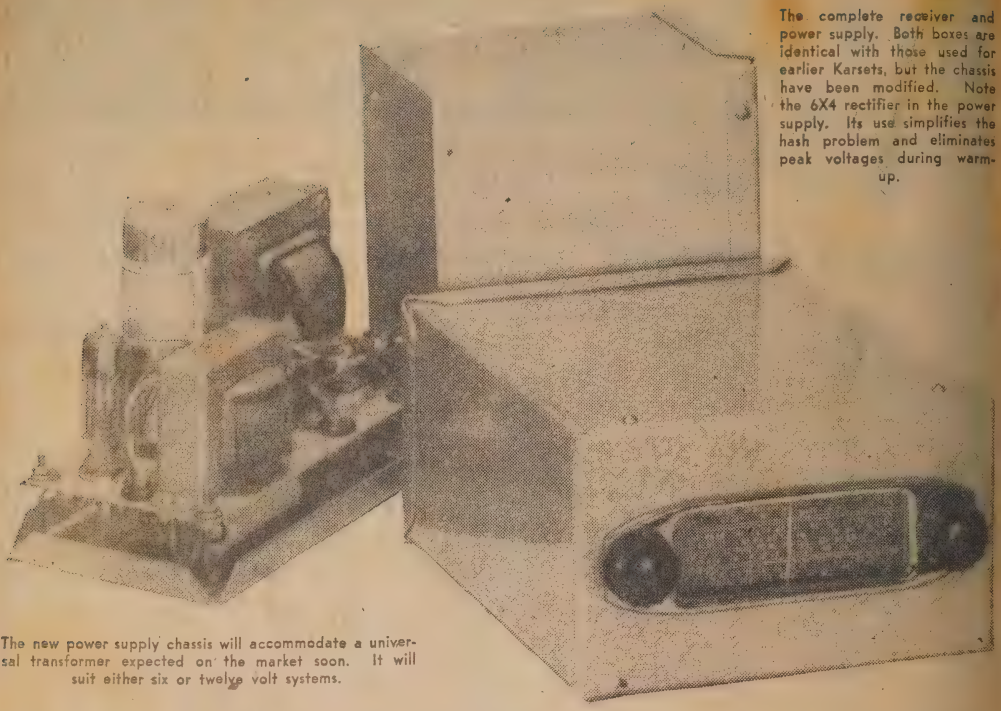
There are rubber based cements of various types which will give the necessary adhesion and at the same time not tend to detract from the flexibility of the suspension.

Finally, when you are satisfied that all is well the ½in paper supports can be removed and pieces of chamois substituted.

SHOULD radio chassis be made from steel or aluminium?

It is often most convenient to make experimental chassis from aluminium because it is easy to work and will not readily corrode in the ordinary way. A disadvantage is that it cannot be soldered with an ordinary soldering iron.

On the other hand steel is cheaper and stronger and can be soldered so that it is best suited to mass produced chassis.



The complete receiver and power supply. Both boxes are identical with those used for earlier Karsets, but the chassis have been modified. Note the 6X4 rectifier in the power supply. Its use simplifies the hash problem and eliminates peak voltages during warm-up.

The new power supply chassis will accommodate a universal transformer expected on the market soon. It will suit either six or twelve volt systems.

THE 1956 CAR RADIO RECEIVER

Here is a really up-to-date version of our ever-popular Karset. While retaining all the performance and good features of its predecessors it incorporates several very worthwhile modifications. As a result it should be even easier to make and get going. If you have hesitated so far to tackle a Karset, this is the one you've been waiting for.

by Philip Watson

Since our first Karset was described, way back in 1949, there has been continuous evidence of the popularity of this type of project. Back numbers containing the first description were rapidly exhausted and every mail brought requests for circuit copies. In addition, coil manufacturers reported sales of hundreds of kits in the first few months following the article.

LATER DESIGNS

On the strength of this, and to meet popular demand, we described a slightly modified version in March, 1952; then a four-valve version in April, 1953. Once again, back copies ran out in record time; once again coil manufacturers reported keen demand.

That was over three years ago, and we still have to keep good stocks of circuits on hand to satisfy readers who missed the earlier versions. In the circumstances we felt that another article, even if it was only a reprint of a previous one, was fully justified.

But we also felt that we could do better than simply present a reprint. In fact, after considering all the factors involved, we decided there was a very good case for a brand new Karset, embodying all the improvements made possible by new components, plus our own and other people's experiences with the earlier versions.

Improved components include capacitors, now smaller and more heat resistant; coils without protruding core adjustments, miniature LT RF chokes, and a miniature ignition suppressor.

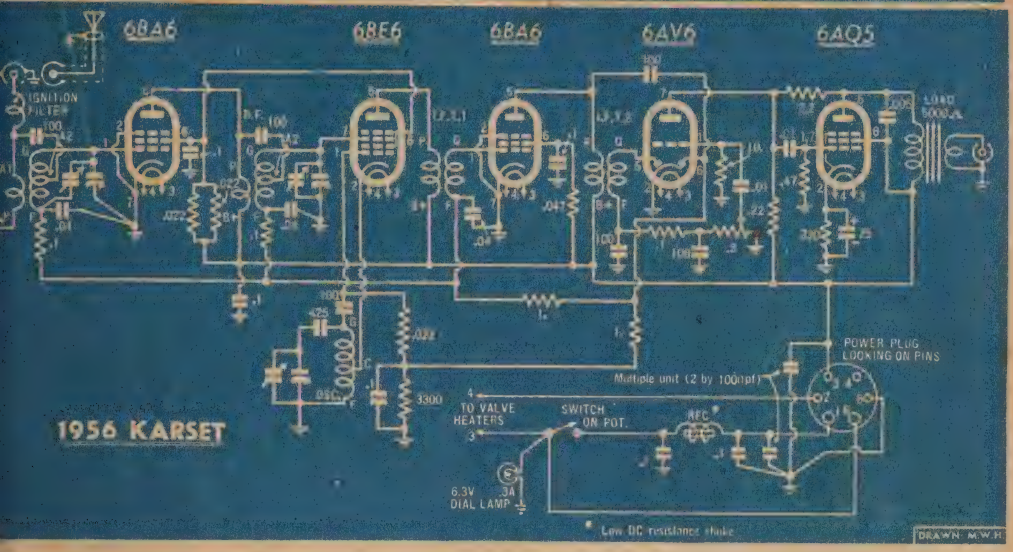
In addition to greater reliability, the smaller components make for a much cleaner lay-out—an important factor where the home builder is concerned. By modifying the power supply to eliminate the peak voltage during warm-up periods we were able to specify lower voltage capacitors, making for a further saving of both space and cost.

From the circuitry point of view there were also a number of minor, though important, changes, which we wished to make. In any car radio, one of the major problems is that of vibrator hash, and it has always been our aim to "build out" as much of this problem as possible in the original design.

GOOD RESULTS

Apparently our previous efforts have met with good results, only a relatively few readers encountering serious trouble in this regard, and these usually responding to a spot of "cut and try". At the

CIRCUIT USES TRIED AND PROVEN TECHNIQUES



The circuit is similar to that used in previous models, most of the improvements being in the matter of layout and earth returns. Note the earth connections shown in the "front" of the set and which are discussed in detail in the text.

me time we could not ignore the fact at this is an ever-present problem as as the home builder is concerned, con-dering all the possible variations in mponents, layout, etc.

Consequently, the better the job we n do, initially, to "build out" the hash, e greater will be the safety margin for e individual builder. If we could build set that was better than "good enough", en the home builder should have no fficulty in making one that was at ast "good enough" — even allowing r some inadvertent modifications.

Experience seemed to indicate that ere were three lines of attack against sidual hash level; the use of a rectifier place of a synchronous vibrator, care-l attention to the elimination of "earth ops", and a particular method of by-ssing the HT line. This had already en tried successfully in the Four-alve Karset.

THER ADVANTAGES

The use of a 6X4 rectifier, in addition reducing the hash level, provides a uple of secondary advantages. One, already mentioned, is that there is r peak voltage during the warm-up riod, thus allowing the use of lower ltage capacitors, both filter and by-ss. The other is that the set is no nger polarised and may be connected electrical systems having either posi-'e or negative earth, without modifica-on.

In the commercial field, these advan-ges appear to outweigh the extra cost d current drain resulting from the ditional valve.

The question of the HT by-passing a very interesting one. Although the act reasons are fairly complex, as th all such circuitry, there is plenty evidence to show that the use of a -pass in the power supply, as well as in the receiver, can appreciably worsen the hash level.

We first encountered this situation with the Four-Valve Karset, and the published design showed only one HT by-pass, being in the set proper.

We took the opportunity on this occasion to check this point once again; with virtually the same results. In fact, under certain conditions, the presence of an extra by-pass in the power supply can raise the flash level by a very considerable amount. It is perhaps significant that all versions of the Four-

PARTS LIST

RECEIVER ONLY

1 Aerial coil AC7 or similar
1 Miniature RF coil RC2 or similar
2 Miniature IF transformers Types 41 and 42
1 Oscillator coil. Suit 6BE6. 05A or similar
1 Ignition suppressor. ICI or similar
1 LT RF choke PC2 or similar
4 Miniature seven pin valve sockets with shield
1 Miniature seven pin valve socket plain
1 Six pin socket with cover
1 Six pin plug with cover
1 Chassis 6in x 5¼in x1in (New punching)
1 Karset receiver box (Standard)
1 Miniature dial MSL/48 or similar. Suit "H" gang
1 Miniature 3 gang tuning capacitor 415 pf. Type RMG3 or similar
1 Speaker transformer 5000 ohms to voice coil impedance. ECG87 or similar
1 Speaker. Size to suit car

VALVES

2 6BA6, 1 6BE6, 1 6AV6, 1 6AQ5

RESISTORS

1 10 meg. ½W
1 2.2 meg. ½W
2 1 meg. ½W
1 .5 meg. Potentiometer with switch
1 .47 meg. ½W
1 .22 meg. ½W
3 .1 meg. ½W
1 .047 1W
2 .022 1W
1 .022 ½W
1 3300 ohm ½W
1 330 ohm 1W

CAPACITORS

1 25 mfd 25V electrolytic
3 .1 mfd 400V paper
3 .1 mfd 200V paper
3 .04 mfd 200V metalised paper
2 .01 mfd 400V paper
1 .005 mfd 400V paper
1 2 x 1000 pf ceramic
1 425 pf mica (5 pc)
5 100 pf ceramic
3 Trimmers
All paper capacitors preferably of high temperature design

MISCELLANEOUS

3 3 tag terminal strips
1 4 tag terminal strip
2 5 tag terminal strips
1 7 tag terminal strip
2 Plug and socket assemblies H160
1 6.3 volt dial lamp
PTIM coaxial cable for aerial lead
Shielded hookup wire
5 mm plastic tubing
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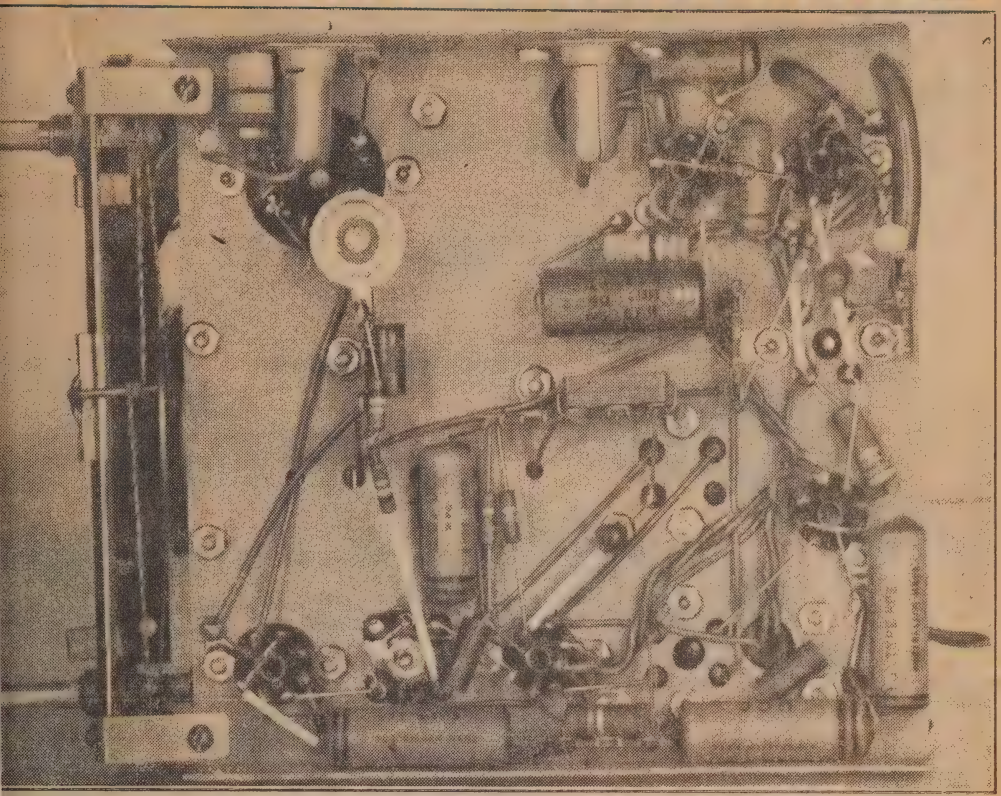


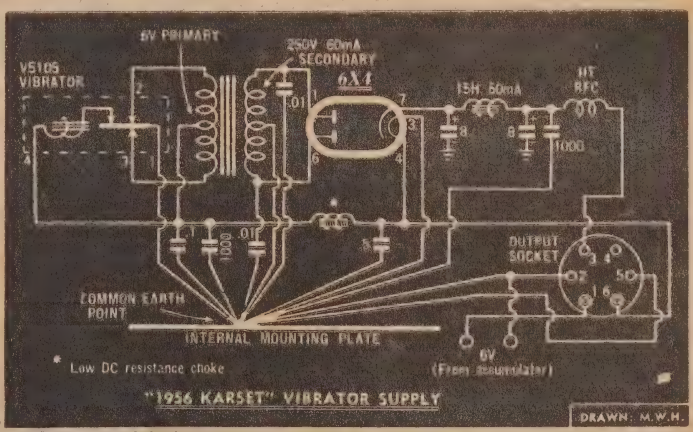
This picture gives an excellent idea of the clean and simple layout which we have achieved in this model. The aerial coil is at top left, the RF valve bottom left, and the RF coil alongside it. Other stages follow in logical sequence.

ve Karset we have so far encountered e been remarkably free from hash. Another point we considered was ether the filament line needed to be elded. We had always adopted this ctice in the past as a routine safety caution, but we had some doubts to whether it was really beneficial. were fortunate in being able to check h someone who had made a great ny Karsets for his customers and o had tried both shielded and un-lded filament lines. His impresison that there was little to choose be-en the two arrangements.

As a result we wired this set with in hookup wire, twisted as for the ventional AC filament line, and re-s certainly seem to justify this ap-ach. It is cheaper, a good deal pler, and more readily converted, if essary, to 12-volt operation. We did even find it necessary to earth the ment line anywhere on the receiver ssis.

Finally, there is the question of earth ps. These are caused by random thing of various components on the neous assumption that all points of chassis are at the same potential. hile this may be true in the general se, and particularly for the DC cir-cuits, it is far from true where very high gain circuits are involved.

When we consider that the input signal may be only a few microvolts, it is easy to appreciate that voltages of a comparable order, at hash fre-



The circuit of the modified power supply using the 6X4 rectifier. Further details of the construction will be given in next month's issue. A possible modification is the use of a transformer suitable for both 6 and 12 volt operation.

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FRW-21	30 w.	12 w.	1"	2"	0.5	25,000	6,000
FRW-22	50 w.	20 w.	1"	3½"	1.5	50,000	13,000
FRW-23	65 w.	26 w.	1"	4½"	2.0	80,000	19,000
FRW-24	75 w.	30 w.	1"	6"	2.5	100,000	25,000

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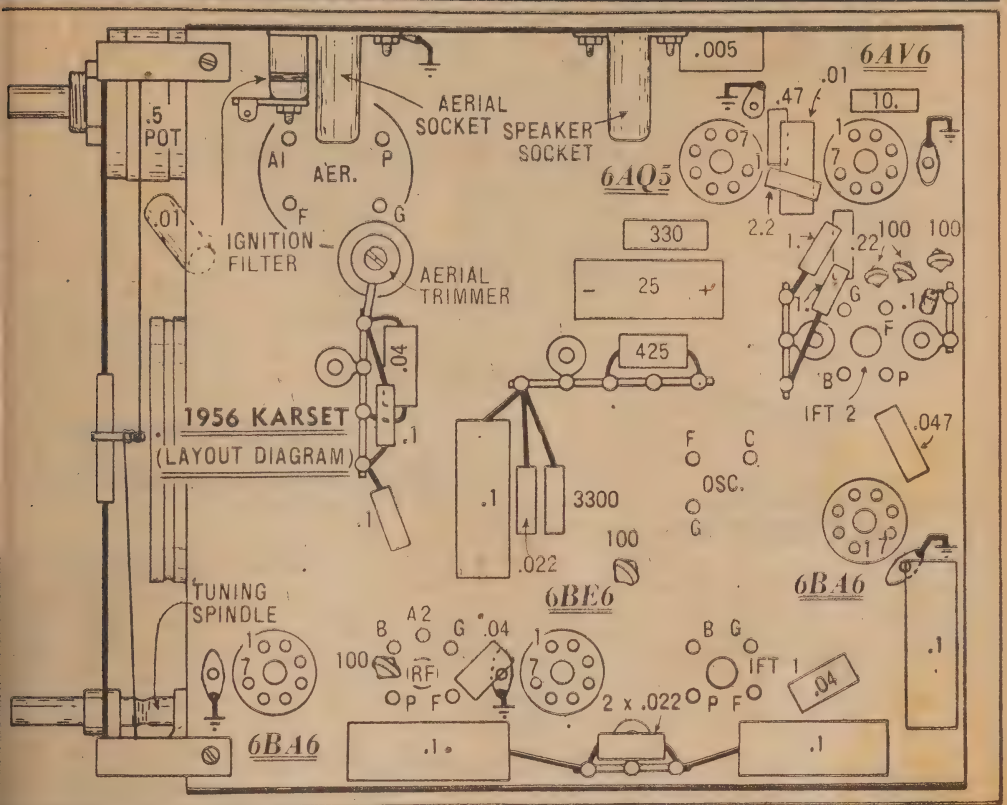
LAYOUT DIAGRAM SHOWS PLACEMENT OF PARTS



Use this layout diagram as an assembly guide prior to commencing the wiring proper. As well as showing the placement and orientation of components it shows the special earth points mentioned in the text. Compare with the photograph on page 67.

encies, can appear between two dif-ent points on the chassis if there is y flash current flowing through the assis.

The solution is to avoid using the assis as part of the signal circuit, par-ularly in the "front" of the set, where e signal level is low. To this end, igle-point earthing is adopted for each ge or circuit carrying signal currents. ius the "earthy" end of the aerial coil imary winding returns to the metal ime of the aerial inlet socket, while e earthy end of the secondary returns, the AVC by-pass capacitor, to the thode of the 6BA6.

ESULT

The result of all these precautions was ite startling. From the moment of t switching on, the set was completely sh free—even with the power supply moved from its box and sitting on the nch only a foot or so away.

Subsequent alignment made no differ-ce and, even at maximum sensitivity, ere is still no audible hash. On this sis, we feel confident that the average me builder should have little difficulty making a first-class job. In fact, hash ould cease to be a problem.

Altogether, we feel that this is a par-ularly fine set. It has sensitivity to spare (we can't measure the exact figure, but it is considerably below one micro-volt, the lowest our generator will measure), is quite hash-free, and uses a clean, simple layout. We think it will be hard to beat.

PHYSICAL CHANGES

So much, then, for the general picture. On the purely physical side we decided to retain the original Karset receiver and power supply boxes, but we found there were some very good reasons for modifying the layout of both the receiver and power supply chassis.

In the case of the power supply, this was dictated partly by the need to accommodate the 6X4 rectifier and partly by our desire to leave room for an alternative transformer, and which may be slighter larger.

This is a universal type, which we suggested, and which a local manufacturer is at present developing. It will be suitable for operation from either six or 12 volts. In suggesting such a design we had in mind the fellow who owns a six-volt car at present, but who may be contemplating trading it in for a new one in the next 12 months or so.

Since virtually all the new cars are standardising on 12-volt systems, it is desirable that the set can be modified with a minimum of expense. By making the transformer universal, the replacement of this fairly costly item is avoided, it being only necessary to modify the filament circuit and fit a new vibrator cartridge — the latter already having given a reasonable proportion of its life, anyway.

However, if only a standard transformer is to be accommodated, it would appear quite feasible to use the existing chassis design without serious modification.

NEW CHASSIS

In the case of the receiver chassis we decided it was time to make a fresh approach. The old chassis design had given good service for both the 1949 and 1952 models, but we had obviously reached the stage where any further changes would start to become unduly "messy", particularly as we wished to avoid modifying the box in any major respect.

As it is there is only one additional large hole required in the box, this being to accommodate the speaker outlet socket, it being undesirable to locate this opposite the existing hole with the new layout.

Another point we wished to improve was the method of securing the chassis in the box. We finally fitted two self-

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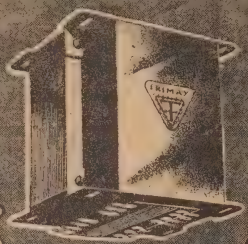

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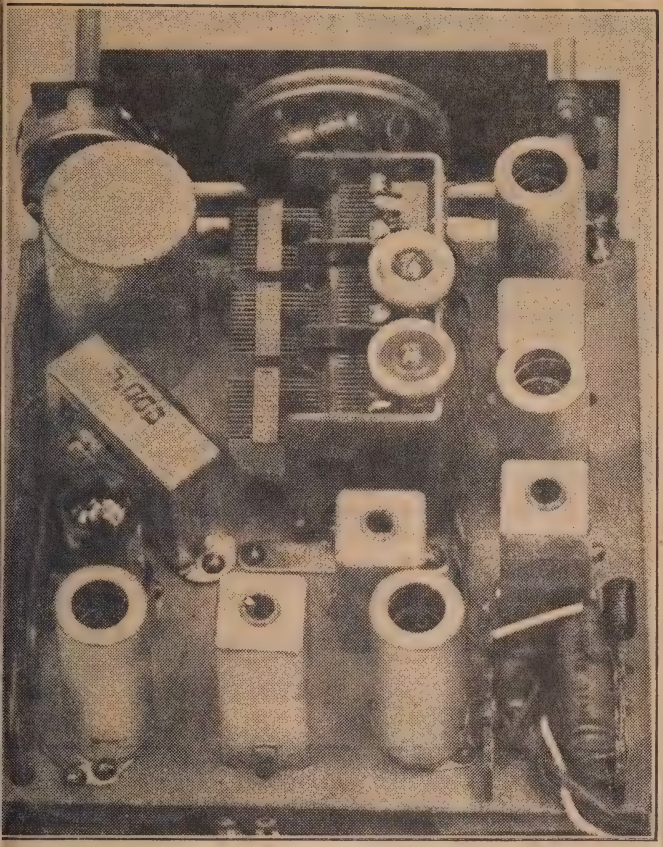
A TOP VIEW OF THE CHASSIS



The aerial coil is top left, the RF coil top right. Note the hash filter components at lower right. The .01 coupling capacitor from the volume control is not visible, its position having been revised after this picture was taken. (See layout diagram).

pping screws, one each side, which pass rough clearance holes in the box and p into holes in the side of the chassis. ake sure that these will not foul any mponents along the edge of the chas-

LEAN LAYOUT

The chassis design which we finally ose results in a particularly clean and gical layout, as can be seen from the derchassis photograph. It also avoids e need for a cut-out beneath the gang, us simplifying the chassis construction. ue prints will be prepared and for-arded to the chassis manufacturers in e usual way.

However, our new layout meant we ad to transpose the tuning control from e right-hand side of the dial, where it normally fitted by the makers, to the ft-hand side. This necessitates re-ringing the dial, but this should not ause the average home builder any ther. The job is best done before the mporary retaining screw, holding the rum, is removed. Make a sketch of the stem, as it stands, before you pull it own.

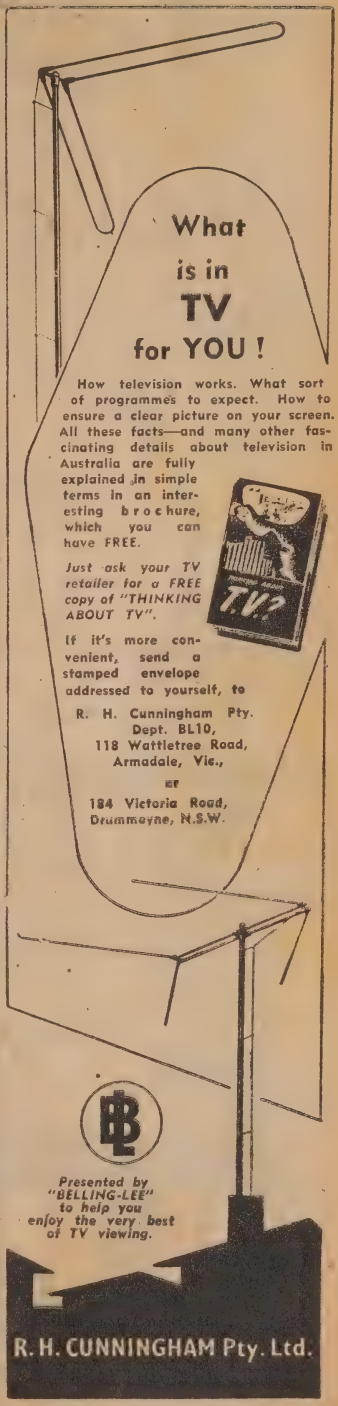
Another change was to eliminate the bracket holding the input plug at the rear of the chassis, the plug now being fitted to the end of a short length of plaited cable. This seems a simpler arrangement, but one which is just as effective.

In place of the hand-wound LT chokes, which we have used in previous designs, there is now available a commercial version, wound on an iron dust core, and which is only a fraction of the size. We used it to advantage in both the receiver and power supply. (It is designated as Q-plus PC2.)

There are two types of miniature coils which immediately suggest themselves as being suitable for this set.

COILS

One type is similar to that used in the earlier versions and which used a threaded brass rod to adjust the core. These had the advantage that the core could easily be locked in position by means of an 8BA nut. They suffered from the disadvantages that the brass rod sometimes threatened to foul the top of the case and that the shield can did not al-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make effective connection to the
is.
e other type is a more recent de-
ment. It uses a core which carries
vn thread and moves inside a card-
former, the latter being designed
thstand, without warping, the high
eratures normally encountered in
adios. The main advantage is that
oil is reduced in height by eliminat-
he brass adjusting rod. A minor
vantage is that the core is not quite
sy to seal.
e makers recommend sealing with
lulose lacquer, such as clear nail
ı and which can be softened with
ers if necessary.
is particular type has only recently
released and we were able to obtain
r of IF transformers and an oscil-
coil for our version. The RF coil
ıot yet been released, the need to
de an additional contact on the
presenting a minor complication.
contact is needed to terminate the
ıdary tapping.)

V DESIGN

, for the present, we have used one
e older style RF coils. The aerial
is a standard size, high gain type,
ally designed to match a car aerial.
e ignition hash coil is also smaller
those used previously, and can quite
be mounted alongside the aerial
socket. To do this it is necessary
nsolder the lead from one of its
inals and clip this terminal off with
r of cutters. The loose lead is then
l directly to the aerial coil pin.
countersunk screw is substituted for
supplied with the coil and used to
nt both the coil and one side of the
inlet socket. Countersunk screws
lso used for the other side of this
et and the speaker socket. This
ys the chassis to fit centrally in the
ver box.
ne assembly of the various compon-
on the chassis is quite straightfor-
, the main requiremnet being to see
the valve sockets and coils are cor-
y orientated for minimum critical
length. We have prepared a layout
ram which shows how this should be
eved, as well as the position of most
ne other components. It also shows
six selected earth points already
ad.
most important precaution to ob-
e throughout the whole assembly
fit all nuts and bolts with reliable
washers and to ensure that each is
and truly tightened. We cannot
s too strongly the futility of expect-
conventional assembly methods to
a car radio. Without suitable pre-
ions a few hours' driving over even
oderately rough road would be suf-
nt to shake the entire assembly to
es.

CKWASHERS

ne other precaution is to mount
tag strip which occupies the centre
ne chassis before mounting the gang,
rwise the fitting of the mounting
will be difficult.
s already mentioned, the matter of
h returns is quite an important one,
we spent a good deal of time work-
out a logical arrangement. In order
we could fully appreciate the prob-
s likely to be encountered by the
ne builder, we deliberately avoided
use of an aluminium chassis (which
ld have been a good deal easier),
made up a steel chassis similar to
that which you will buy ready punched.

Then we set about determining the best means of making chassis connections to it. Steel always presents a problem in this regard, the risk being that mechanical connections will be adversely affected by rust unless they are very well made.

On the other hand, reliable soldered connections to the chassis are virtually impossible with the ordinary 60 or 75 watt iron, due to both the mass of metal involved, and the fact that steel is not the easiest metal to solder.

In spite of this we decided to use soldered connections, and we strongly advise the reader to do the same. It means you will have to use a heavy duty iron, but it should be possible to arrange this in most cases. One of the low voltage quick heating types are ideal, but even the humble plumber's iron, heated on the gas stove or a primus, will do a perfectly satisfactory job.

There are only five such connections, one at each valve socket, and these may be made in the one operation immediately after the assembly. All subsequent wiring may then be done with an ordinary iron.

However, if you feel that this is an undesirable complication we can only advise that you make each such connection as mechanically perfect as possible. Clean the metal surface carefully and clamp a solder lug to it as securely as possible, using a lock washer under the nut. If you take similar precautions with the second socket mounting bolt you will have another line of defence, the two points being close enough together to be interchangeable, and electrically bonded by the valve shield base.

The idea of bonding the various points together with tinned copper wire, rather than the above-mentioned method, appears to be the least desirable approach in this case.

EARTH POINTS

To provide the required earth points we suggest the following technique. Temporarily fit a double-ended solder lug over the mounting bolt (see layout diagram) and mark the chassis at the end to be earthed. Remove the lug and drill into the chassis with a 1-8in drill just far enough to produce the full 1-8in diameter hole.

Apply a spot of paste flux and, using a really hot iron, fill the hole with solder. Then fit the solder lug in place and solder it to this point. Components to be earthed can be connected most conveniently to the other end of the lug.

(Continued on Page 125)

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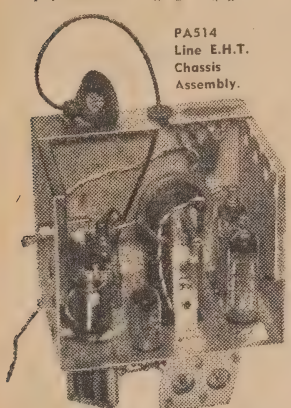
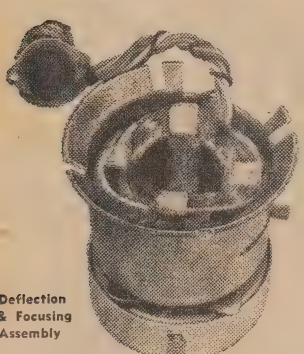
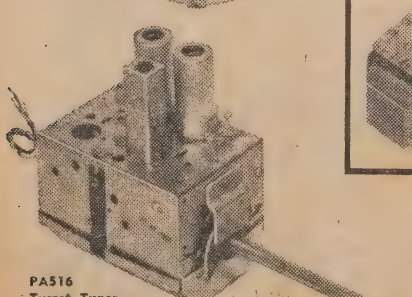


PA514
Line E.H.T.
Chassis
Assembly.

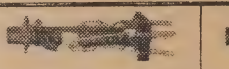


Deflection
& Focusing
Assembly



PA516
Turret Tuner

L146 Coupling Coil Yellow.

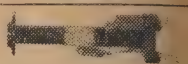


L147 Video I.F. Coupling & Trap Coil Green.

L148 Coupling Coil Blue.

L149 Coupling Coil Violet.

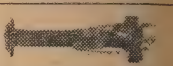
L150 Video I.F. Sound Trap Coil Orange.



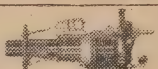
L151 2nd Video I.F. Transformer Red.

L152 1st Video I.F. Transformer Brown.

L187 1st S.S. MC/S I.F. Trans. White.



L188 S.S. MC/S I.F. Transformer Black



L189 F.M. Ratio Detector Transformer

L192 Video Sound Trap Coil Grey

T129
Line Linearity
Coil.

T110 Filter Choke.

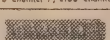
T125
Line Blocking
Transformer

T126
Push-pull
Line Sync Trans

Aerial Coils: L166 Channel 2;
L176 Channel 7; L180 Channel 9.

Filament Chokes:
L154 Green; L155 Yellow; L156 Red.

L185 Filament Choke

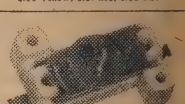


Mixer Coils: L167 Channel 2.
L177 Channel 7; L181 Channel 9.

Video Compensating Coils:
L160 Yellow; L161 Red; L162 Blue

L214 Neutralising Coil

T115
Frame Output
Transformer.



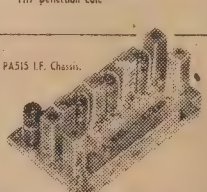
Trimmer Condensers: C118, C212.

A101/821 Deflection Coil Assembly.

T117 Deflection Coil.

T116
Horizontal Output Transformer

T112
Power Transformer.



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FROM THE SERVICEMAN WHO TELLS

Most of my remarks this month seem to be a follow up of stories of a few months ago. There is a reader's comment on electrical safety, another case of a faulty high stability resistor, and some further comment on the reliability of paper capacitors. The latter was prompted by a typical intermittent in a car radio.

LOWING my remarks in the Aug-ist issue about the safety of electri-ppliances, I received a letter from a rian reader, Mr. L.C.G., of Yarra- along the same general lines and ibing a case which he recently en-ered. I will let him tell the story own words.

was approached one Sunday morn-by a neighbor who lives opposite the statement that his good lady received an electric shock from the erator.

am a refrigeration engineer by and, as I was for many years asso-d with the company whose product in question, I was naturally inter-. I grabbed a few tools and a test (100 watt) and set out to tigate.

irst I removed the top of the three utlet and found that the earth pin an earth wire attached, but con-ng the lamp between the active and produced no result.

urther questioning of the house-e brought to light the information at the time of receiving the shock ad one hand on the 'fridge' door e and the other hand on the gas Something had started to boil e she had reached over to turn down as, and—'bingo'.

Connecting the 100 watt lamp be-the refrigerator and gas stove pro-a beautiful light!

ell, we had to find the other end at earth wire, as all other earth ctions were OK. So I went outside found it: about nine inches of it ng out between two weather boards, ell smothered with paint.

"My friend stated that it had been in this condition as long as he could remember, so I produced an earth clip, soldered an extension to the earth wire, and securely fixed it to the water pipe.

"On switching on—yes, the fuse went with a bang—the light fuse! Obviously the same earth wire was looped to the conduit carrying the light circuit, and the active had broken down. I eventually found the cable, with insulation cut through at an elbow, and replaced it. Everything then behaved normally.

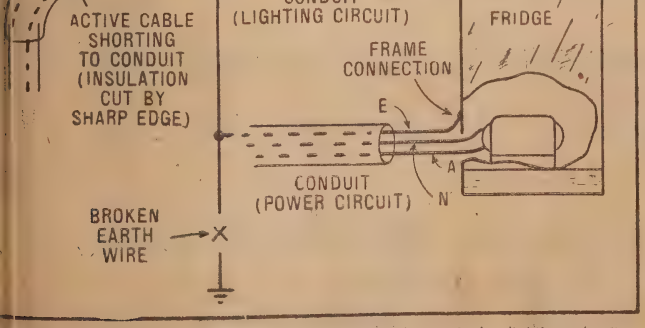
"I bring this subject up to show that, even in Melbourne where the S. E. C. V. is so strict and careful, accidents can happen, and in the hope that some readers may benefit from these experiences.

"Any length of wire around the premises should be treated with respect if its purpose is not known, and steps taken to determine what it is and whether it may be dangerous.

"As my friend paints his own house, it was apparently only a coating of paint which saved him from electrocution on more than one occasion especially as that side of the house is damp underfoot."

Well, thanks, Mr. L.C.G. and I could not agree more regarding unidentified wires lying loose around the place. The prospect is even more serious when there are children in the household. The combination of bare feet and an inquisitive nature—it makes one shudder to think about it.

Reverting to the above case, it would be very interesting to know just how that earth wire came to be disconnected in the first place. My bet is that the fault in the conduit had been of long standing and that when it had first occurred, some "wise guy" had discovered that he could prevent the fuse from blowing by disconnecting the earth wire. Having thus "cured" the fault he had considered it unnecessary to take the matter any farther.



The defects—the damaged insulation on the active lead of the lighting circuit and the disconnected earth lead—were responsible for the "live" fridge. Whoever originally disconnected the earth lead nearly had a corpse on his conscience.

And while on the subject of earth wires, a near neighbor of mine ran into some trouble with his electrical system recently. Like many another person these days, he is building his own house; living in one portion while he finishes the remainder. He had reached the stage where he called in the local electrician to wire the new portion for lights and power points.

A KNOCKBACK

This was duly done, after which the electrician notified the council and awaited their OK on the installation. To the surprise of both the owner and the electrician, this was not forthcoming, the installation being "knocked back" on the score of an incorrect earth connection.

Consultation with the inspector revealed a rather interesting state of affairs. When the house was commenced and power first connected, there was no reticulated water supply, the occupants having to rely on tanks. In these circumstances the electrical earthing system was earthed in the manner prescribed, i.e., to a piece of water pipe driven so many feet into the ground a J having not more than so many ohms resistance (about 300, if I remember correctly) to the earth proper.

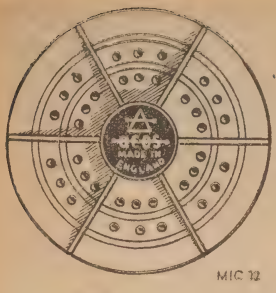
A few months later, the water mains were run down the street and the tanks were discarded. But nobody thought to do anything about the earthing system, which remained as it was for a couple of years while the remainder of the house was completed. It was only when the inspector was called to check the additional installation that the situation was discovered.

When it was, he flatly refused to pass it until the electrician had transferred the earth to the water pipe, with approved brass clamp, protective paint, warning plate and all the rest.

EARTHS GOOD & BAD

The owner was a bit browned off about the council's attitude. He felt that they were being a bit "hard to get on with". After all, the original earth had been good enough before there was a water supply; why wasn't it good enough now?

As a matter of fact, there are some very good reasons why it was satisfactory then and not now. When it was installed it would represent about the best earth connection that could be made, taking into account type of soil, natural moisture content etc. In the circum-



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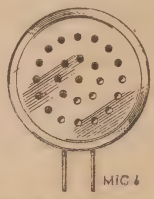
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ces it would be extremely unlikely anyone, i.e., a potential victim, d make any better connection to the h, even under the most favorable itions.

hus a fault, which connected the hing system to the active line, would be likely to raise the potential of the h wire by a dangerous amount, rela- to any other available earth con- ion. But immediately the water sup was connected the situation was pletely different. Every tap and bare r pipe represented a very much er earth connection than was present he electrical system, meaning that angerous voltage could be present een the earth wire and the water

RTH RESISTANCE

o make matters worse, I have been by an electrician friend that it is very hard to maintain the pre- ed value of resistance in these im- rised earthing systems during dry her, and that it can often rise to 0 ohms or more. Once again the sit- on is not so bad when no better n is available, but becomes positively l when a water pipe is within reach.

is with good reason, therefore, that authorities insist on the earth being n to the "earthiest" point—if I may such an expression. In this way do their best to ensure that no can ever encounter a better earth, for which, in my book, they get marks.

y next story is really a followup case I described in the April issue h concerned a new control unit h failed to work because one of the d new high stability resistors was circuit.

ncidentally, I subsequently received tter from a reader who pointed out these resistors are very easily dam- by gripping them with long nose s while soldering them into place. this seems a reasonable suggestion passing it on for the benefit of s who may encounter these devices.)

his case concerned an experimenter had attempted to build the Radio Hobbies VT Voltmeter (September, 5). Although I didn't come into the re until much later, I learned that t out to do the job properly. Every- brand new, a careful study of the nal article, then many hours of ly careful work in assembling and g the unit.

GRAND SLAM

Imagine his disappointment, therefore, he switched it on and was greeted e most erratic performance. Main plaint was that the meter slammed over and no amount of adjust- t of the balancing controls would ect this condition.

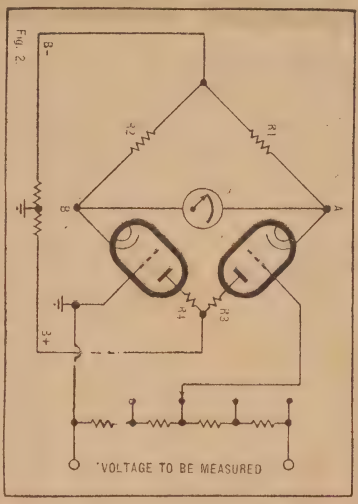
Unfortunately, our friend was not in ry good position to start trouble- ing on a project like this. His erience was limited and he had vir- no test gear. In fact, this meter s his first step toward correcting this rt of affairs. (I don't necessarily k that this is an ideal first item of equipment for a beginner to tackle. r better to try a simple multimeter st)

Anyway, our friend was stumped. He ked the wiring, could see nothing ng, but felt convinced that he had a "blue" somewhere. Finally, in desperation, he made the same mistake as do many beginners who doubt their own work. He ripped the whole thing to pieces and started all over again.

When, for the second time, the thing refused to balance and he could still see no obvious reason he exhibited a stubborn tenacity worthy of a better purpose. Yes, you've guessed it! He ripped it to pieces again and had another try.

When this version was completed it was no better than the previous two and our friend was just about at the end of his tether. It was then that he sought my assistance. Lifting the various resistor strips out of the unit, but leaving them essentially intact, he brought them to me with the request that I test them.

I listened to his story, not without some amazement I must confess, and then spent some minutes familiarising



Simplified circuit of the measuring bridge showing how all four legs must be intact to produce zero reading on the meter. Violent full scale deflection indicated a fault in one leg.

myself with the circuit. As far as I could see there were two possible causes of his trouble. The .05 meg resistors in the cathodes of the 6SN7 would cause trouble if they were badly out of tolerance. I even considered the possibility—before I saw the resistors—of a wrong color band on a .5 meg., making it look like a .05 meg. It would not have been the first such case.

Subsequently the resistors turned out to be high stability types without color coding, thus exploding that theory. The other possibility appeared to be the .01 meg. pot. used as a zero setting control. If one end of this were open the whole system would be hopelessly unbalanced. Otherwise I could only suggest that one section of the valve was faulty, though I was assured that this had been tested and pronounced OK.

Since the .05 meg. resistors seemed the best bet I tested them first and, sure enough, there was the trouble. Not merely a high value, but a perfect open circuit, not even a high reading bridge being able to produce a reading. Remembering my correspondent and his comment about pliers, I examined the body of the resistor very carefully. As far as I could see there was absolutely no evidence of any damage, and the owner assured me that he had not used pliers on it at any stage.

I can only assume, therefore, that an occasional one of these otherwise high quality devices does pack up before being put into service. I only hope it remains an occasional one because, when they are faulty, they certainly cause some strife.

Coming back to the circuit, just why did the instrument behave as it did, and how was I able to narrow the possible cause down to two or three components?

Although this circuit looks complicated at first glance, it is basically quite simple when stripped of its "refinements". The simplified circuit shows it for what it really is—a balanced bridge arrangement having valves instead of resistors for two of the arms.

BRIDGE CIRCUIT

In accordance with the operating principles of all such bridge circuits, there will be no voltage between points "A" and "B"—ie, across the meter—when the resistance ratio between R1 and the upper valve is the same as the ratio between R2 and the lower valve. This condition is that which normally applies when the instrument is switched on, but not in use. When a voltage is applied to one of the grids, the balance is upset, and the meter reads up the scale by a certain amount.

Failure to obtain initial balance, particularly when accompanied by such a severe meter reaction as was described, could only mean that one arm of the bridge was a long way out of tolerance. In the complete circuit the two .05 meg. resistors are the equivalent of R1 and R2, the two sections of the 6SN7 are the two triodes, and the .01 meg. pot. replaces R3 and R4.

Since the valve had been tested and was presumed OK, that left only the two .05 meg. resistors and the .01 meg. pot. Simple, isn't it?

Having diagnosed the trouble I passed the faulty resistor back to its owner, along with some suitable comments. I gathered he entirely agreed with my sentiments.

However, apart from the obvious, advice regarding the faulty resistor, I felt bound to make some comment regarding our friend's approach to the problem in the first place. It's only my opinion, of course, but I have never been able to see any point in stripping down a complete piece of equipment, representing many hours' work in some cases, simply to cure one fault.

STRIP TEASE METHOD

For one thing, it is seldom that such a process is really effective in solving the problem—certainly not when a faulty component is involved—and, for another, even if the rebuilt device does work, one is left with the frustrating situation of still not knowing exactly what the trouble was.

Far better, I think, to tackle the problem while the unit is intact, if only because one has the fault in a tangible form which can be dealt with. In many cases, as in this one, the actual fault is simple and easily rectified once one gets to grips with it. After all, I know which I would rather do if I had the choice between completely rewiring an

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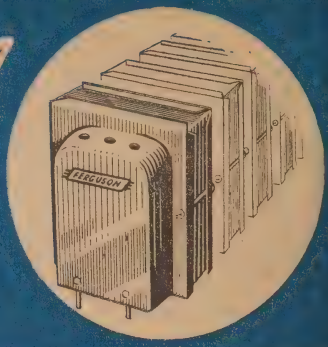

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10 WATT P.A.	(RT & H SEPT '53)	PF170	CF105	OP58
PLAYMASTER No. 1	(RT & H OCT '51)	PF173	CF111	OP25
PLAYMASTER No. 2	(RT & H NOV '51)	PF152	CF196	OP63
PLAYMASTER No. 3	(RT & H JAN '52)	PF170	CF105	OP113
PLAYMASTER BABY No. 4	(RT & H DEC '51)	PF151	CF103	OP183
PLAYMASTER No. 5	(RT & H JUNE '52)	PF167	CF109	OP66
BATTERY PLAYMASTER	(RT & H MAY '53)	VT104	CF119 / CF108	OP24
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PLAYMASTER No. 10	(RT & H AUG '55)	PF152	CF196	OP301
PLAYMASTER No. 11	(RT & H AUG '55)	PF152	Not used	OP301
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rument or tracking down and re-ing a faulty resistor.

o, to my younger and less exper-ed readers particularly, I offer the e advice as I did on this occasion. If encounter a puzzling fault in a new e of gear, don't admit defeat by oping it down. Stick with it, or at t enlist the aid of someone who can o you. When the fault is found you at least have the satisfaction of wing what it was and will have ned something about cause and ef- into the bargain.

Which brings us to this month's in-nittent—a car set this time. My first ounter was when the owner drew up ide the shop and asked me if I would ie out and listen to it. This I did, and he set warmed up, our ears were as-ed by the most violent hash I have rd for a long time. I tuned over the d, satisfied myself that the set seem-o be working normally in other re-ts, then quickly switched off. What-the trouble was, I imagined it ld not be doing the associated com-ents any good.

DDEN TROUBLE

ccording to the owner, the onset of trouble had been quite sudden, hav-happened only the night before, and reception being perfect one second terrible the next.

was all for taking the set out then there, but the owner had other s. It seemed that he was in rather rry just then, and thought it bet-o leave it until he had more time. e drove off, promising to call in in a few days' time.

fact, I didn't see him again for a ole of weeks. Then he hailed me in street one day and cheerfully advised that the set had "come good" the after his visit and had been going ectly ever since. In the circum-ces, he didn't think it worth worry-me about it any further.

it I wasn't convinced. Faults just r repair themselves like that—well, permanently, anyway. Sooner or they come back—generally at the inconvenient time. However, the ler wasn't over-keen to have anything immediately and, frankly, neither I, though for a different reason.

couldn't see much point in trying ack a fault which, for the moment, virtually non-existent. Far better ait until it showed up again, in the that it would remain operative r enough for me to come to grips it. So I bade my customer good-with the parting suggestion that he ne tackle the thing as soon as it ed up.

RE TROUBLE

nce again I didn't see him for some s. Then he drove up to the shop day, demonstrated that the set was again faulty, and requested that I it out and fix it. So, about half an later, he drove off, minus the set, e I retired to the workshop to tackle e thing, hoping that it would stay ok" just a little longer.

t not a hope. As soon as I switched it played perfectly, and continued so in spite of all the abuse I could out to it. This went on for a ule of days, the set being played, ched on and off, bounced on the h, and prodded at every opportun-ity. It was no good. The thing flatly refused to misbehave.

By this time the customer was diffi-dently inquiring whether he could have his set back by the weekend, and I de-cided the situation justified taking some-thing of a chance.

Right from the start I had considered the most likely cause would be the buf-fer capacitors, or capacitor, more cor-rectly, since there was only one across the full secondary winding. It was a .008 mfd 2000-volt type, and I decided to replace it "on spec", put the set back in the car, and advise the owner of the circumstances.

SUCCESS AT LAST

So I duly obtained a replacement—it was not a type I normally carry in stock—fitted it in the set, checked the performance again, and contacted the owner.

When he called at the shop I explain-ed the situation, pointing out that I had been unable to observe the fault and had simply replaced the most likely com-ponent. I was relying on him to advise me if the trouble showed up again. Then I began replacing the set in his car.

Before actually doing so, I decided to give it one last try. I sat it on a card-board carton on the floor of the car and plugged in the power and speaker leads. Imagine how I felt when the set warmed up and there was the hash, just as bad as ever. Well, at least I could get to grips with it now.

Not daring to even switch the thing off, I prised off the bottom cover and gazed at the works. After the buffer, the most likely culprit seemed to be the .01 mfd RF by-pass in parallel with the first electrolytic, that is, from the 6X4 cathode to chassis.

I fetched another .01 from the shop and bridged it across the existing one. The hash vanished. I removed it, and the hash returned. I did this a couple of times with the same results. Then, on an impulse, I reversed the temporary capacitor—now fully charged to the HT voltage—and connected it across the sus-pect one again. There was a "splat" as the two opposing voltages met, then, when I removed the new capacitor, the hash had vanished.

POOR CAPACITOR

As far as I was concerned, the point was proved. Apparently the heavy surge of current, which occurred when the re-versed capacitors met was sufficient to "repair" the fault within the suspected unit—at least for the moment. I had no hesitation in cutting it out of the cir-cuit and fitting the new one in its place.

Then I fitted the set back into the car, checked it again for overall performance and sent the owner on his way. That was several weeks ago and his latest report is that it is completely satisfactory. I don't think I shall be troubled by that intermittent again.

Incidentally, a few months ago I sug-gested that it was time our capacitor manufacturers pulled their socks up and gave us something more reliable than the present product; particularly with TV so close and the prospect of a com-ponent such as I have just described ap-pearing in a TV set.

I was happy to learn, therefore, that at least one manufacturer had appar-ently anticipated my remarks. It is un-likely that these had anything to do with

(Continued on Page 123)

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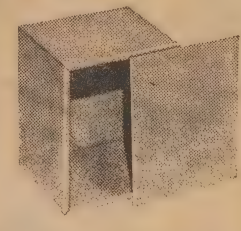

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Let's Buy An Argument

Poking fun at a "popular" explanation of some technical problem is an ancient but rather futile kind of sport. If I appear to have weakened this month sufficiently to indulge in the same, it's only because of the provocation.

by Neville Williams

ON the opposite page you'll find a verbatim reprint of an article which purports to explain the operation of color television. It comes from a journal which I haven't seen before and which would appear to have international circulation.

The article may well have suffered the consequences of translation but it certainly has suffered—or maybe it was a weakling from birth!

Whatever the explanation, the end result is pretty tragic.

PREWAR TV

The article starts off with a statement that TV was offered to the public in 1949, thereby completely ignoring all the efforts of the BBC prewar.

Then, as if by way of compensation, it suggests that color receivers are now on sale in Britain, which is about as far from the truth as it possibly can be.

The BBC have certainly carried out tests in the laboratory but only with a view to assessing the merits of color TV, its adaptability to British standards and all the associated problems of transmission and reception.

At the time of writing, there is no suggestion that British authorities have even decided their policy on color TV. Things certainly haven't reached the stage where receivers are available on sale, not by a long shot.

Even in the US, where the color market is gradually opening under enormous pressure from big radio firms, the editor has pointed out that color telecasts are still fraught with technical problems.

However, that's just by way of general comment on what patentees like to refer to as "the state of the art".

As the article in question progresses into more technical matters, it takes on the character of a lukewarm meat pie—the farther you get into it, the worse it becomes.

The writer might be pardoned, al with many others, for confusing primary colors, though he will certa confuse his readers at the same time.

As we have pointed out on previ occasions, red, blue and yellow in co bination are not primary colors at a

The combination which the desc tion most nearly fits is magenta, c and yellow, these being the prim colors required for any subtractive s tem of color presentation.

ADDITIVE SYSTEM

But all practical color televis systems use an additive system presentation to the eye, for which primary colors are red, blue and gre

Having straightened that one out, remainder of the article doesn't warr detailed comment.

Apparently the writer has been aw of the original Columbia disc syst and the later NTSC all-electronic co system. Mention of the "corruga screen" even carries a hint of the La rence or similar tube but, instead being separated, the whole lot gets mi in together.

I only pity the poor reader who to try to build up some kind of mea picture out of it all.

Or, alternatively, the reader who, h ing done so, has to disabuse his m in order to start again.

Finally, there's a certain intriguing airy quality about a particular senten near the end.

Having referred to the problems televising in color, the writer says, "I naturally this will be quickly develo ed."

AN RT & H "EVERGREEN"

It reminds me of an interview wh the editor and I had some years a with a technical bod. The details ha long since escaped me but one phr has lived on to become a byword in RT and H laboratory.

The bod in question was most ke about some idea or circuit which b the editor and I immediately brand as impractical.

Undaunted by our collective opini our friend went on for a full five m utes, expanding on all the ancillary c cuits and the benefits of the scheme. I at long last he had to come down to very core of the idea, the part that w completely unworkable.

"But what are you going to do abo this?" we persisted.

"Ah," he said, with a slightly na

puzzled expression on his face . . .
hat's the hard part!"
owever, enough of that and of art-
on color TV. Perhaps I'd make
as big a mess of things in trying to
in some of Einstein's theories for
and H readers. But first I'd have
d someone to explain them to me.
that mightn't be easy.
eaking of explanations, a letter from
ader in Lakemba, NSW, calls for
attention. I quote:
ear Sir,—I have a matter on my
which I feel might rate discussion
he 'Argument' page some time or
as others may have had similar
hts. Here goes:

DER'S LETTER

ver the years, whenever the ques-
of frequency doubling or multipli-
n has arisen, your esteemed journal
atiently explained that such a thing
ade possible by arranging that the
is rich in harmonics, in addition to
undamental frequency. The doubler
can then be tuned to any selected
ency which is a multiple of the fun-
ntal.
owever, for some reason which I
ot explain, this never appealed to
It seemed somehow to be a bit

uring the war, while doing a course
adio, with particular reference to
well-known AT5/AR8 gear, the
ler stage in the AT5 was explained
y instructor in terms of the 'fly-
l effect' theory.
naturally assumed at the time that
had then superseded the 'Rich in
onics' theory, and it had an imme-
appeal to me because I saw at
that it was possible to double a
frequency because the oscillator
in effect, 'nudging' the tuned cir-
in the doubler on every second os-
ion.

WER RATIOS

saw also that the output as a doubler
d be about half what it would have
if tuned to the fundamental, and if
econd stage were tuned to n times
undamental it would be nudged on
nth oscillation and would have
t 1/n of the possible output.
y the same token, division was also
nted for, and all from a single pure
amental, without harmonics. And I
ght I satisfied myself by variously
plying the output in an AT5 using
als in the oscillator to ensure a
g fundamental and negligible har-
cs.
magine my confusion to find that
in May, 1956, you are still say-
that an oscillator tube is operated
portion of its curve which will give
utput rich in harmonics so that the
ler can 'select' the second har-
c.
rankly, I'm still happy with the fly-
l theory, but I'm open to a reasoned
nation, and I assure you that I
take your word as final. This is the
letter I will write you on the sub-
I promise. How about it?"
can assure our correspondent, E.H.,
he does not need to be so solicitous
ur feelings as to promise not to
again on the subject. A truly ar-
ntative type keeps coming back for
—and with more!

COLOR TELEVISION:

How it works (?)

TV, latest of the popular entertainment and cultural mediums is now on the verge of breaking through the color barrier on a big scale.

France, the Soviet Union and Switzerland have carried out their first experimental transmissions in color and sets for color TV are on sale in Britain and the U.S.A.

One could say TV comes of age, joining the cinema and photography in the color field. Both photography and the cinema began in black and white and in its early days the cinema lacked sound.

TV got a better start in life when it was launched on a public scale in 1949. Then in 1950, the opening of the 2nd half of the 20th century saw the first introduction of color in TV.

Let's have a look and see how scientists tackled the color problem.

But first of all it's necessary to have a look at how black and white TV operates. The secret is in the cathode ray, that is rays which are given off from the cathode or negative pole.

What happens is that the original picture is methodically "beamed" and each point in the picture is transformed into an electrical current which varies in intensity with the degree of blackness of the point.

Then at the receiving end the procedure is reversed on a luminous screen with electrical impulses being converted into points on the screen, all the points making a complete picture.

But for color it is a different question, we'll have a look at the tricks used to solve this problem.

Color Transmission

Let's take three colors: red, blue and yellow. The problem is posed in the following way: the first is beamed on the red parts. The second (very quickly) on the blue parts. The third and last beam on the yellow parts. And if all this is done three times as quick as usual, the triple beaming only lasts as long as one in black and white.

Now one of the difficulties of the modern process is to use the three different wave lengths, if you prefer three different frequencies. Technicians say that this is a question of three "channels".

Of course, there are several processes. We can skim over them to try to understand the different principles.

The Colored Disc

When transmitting, the picture, naturally colored, is analysed by a first beam (beam 1), which only operates on red surfaces, and that at a determined frequency. A second beam (beam 2) at a second frequency and only on blue surfaces. The third beam in the same way, at a different frequency again, on yellow surfaces.

On reception a red, blue and yellow disc turn in synchronism, that is to say, they coincide with the arrival of the different beams, in such a way that the beams arrive through the red disc in red. The second beam arrives through the blue disc in the same way and the third beam arrives in the yellow through the yellow disc.

The Corrugated Screen

If on reception there is a "corrugated screen", as in our drawing, you can see that the special circumstances allow beam 1. (red) to only reach the vertical part of the screen. beams 2. (blue) the lower oblique, and rays 3 (yellow) the upper oblique part.

Once more the colors are dispersed according to the desires of the operator.

What of the Future?

To reset the colors on the screen, these are the new and grand possibilities enriching science, but the spectacular side will win first.

No doubt this new creation of science will not be delivered to the world without certain difficulties, especially for the manufacturers.

In fact, the present television apparatus is only built for black and white transmissions, and therefore it is necessary to obtain another apparatus for the colored transmissions.

But naturally this will be quickly developed.

After that, there is nothing more to do than put this great invention at the disposal of every one, for the engineers to continue their efforts and perhaps give "odoravision" tomorrow, making it possible for us to admire some beautiful scenery in a faraway country, in all its splendor of colors, at the same time smelling the flowers! May be sometime . . .

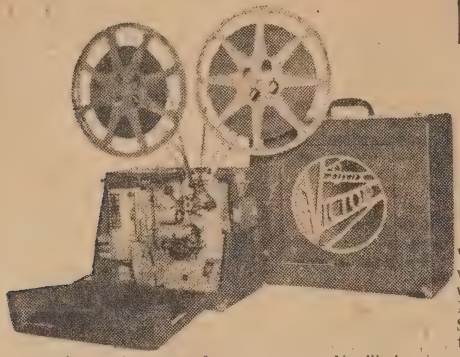
However, E.H.'s comment is constructive and leads on to a subject which I can't recollect having covered before in these columns.

First and foremost, let me say that it isn't a question of one theory versus another theory. There is truth in both points of view and the best mental picture can probably be built up from a combination of both. Let's try.

The operation of an RF amplifier stage in a transmitter does normally depend on the "flywheel action" of the tuned output circuit.

In this respect it may be likened to a two-stroke petrol engine, in which one

AT LAST..! a few more available



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t per revolution of the crankshaft
s the flywheel spinning at a sub-
ially smooth rate.

ie inertia of the flywheel and of the
ponents coupled to it allows work-
gy to be delivered at a smooth rate
e load, even though the energy was
nally released as a series of inde-
ent thrusts.

E PER CYCLE

a class C RF power amplifier, cur-
bursts in the plate circuit keep the
"tank" circuit in a state of electri-
oscillation and RF power can be
n from the "tank" at a relatively
gth rate.

a straightforward class-C amplifier
, there is one burst of plate current
ach RF output cycle.

hen an amplifier stage is to be used
frequency doubler, the plate output
it is tuned to twice the frequency
ie input signal. The operation then
mes analagous to a conventional
-cycle petrol engine (single cylinder,
ourse).

such an engine there is only one
er stroke to each two revolutions
he crankshaft and the flywheel is
: than ever vital to its operation. It
irly evident that the power available
such an engine will be less than
a two-stroke type, unless the thrust
the piston is increased to make up
difference.

an amplifier-doubler (and to use
's phrase) the valve "nudges" the
d circuit each alternate cycle and
s it in a state of electrical oscilla-

ie same observation about power
ing applies as with the engine anal-

The work-power available from a
ler is bound to be less than from
raight amplifier, unless the power
ained in each individual "nudge" can
ncreased to compensate.

the ordinary practice and economy
ansmitter design, there is a limit to
mplitude of "nudge" available from
given type of valve. It thus fol-
that the power output will dimin-
as the order of frequency multipli-
n is increased.

TPUT POWER

ie relationship isn't quite as simple
.H. infers, because the power output
able from a frequency multiplier
es to the degree to which one is
ared to prejudice the "flywheel" ac-
of the tuned circuit.

far so good. Now let's have a
r look at this "nudging" business.

sustain oscillation in a frequency
ling" tuned circuit, the least suitable
e of energy would be a pure sine
from a class-A amplifier. The
n for this will be apparent from
igure 1a.

t's say that the solid curve repre-
the natural plate current cycle of
driving valve. Further, that the
d curve represents the circulating
ge or current in the resonant plate
it, this being tuned to twice the
signal frequency.

ere is no problem during the first
cycle, period (a), because the plate
nt excites the tank circuit in the
sense.

uring the next half-cycle, period (b),
relationship between the natural plate current and the circulating plate current is complex and the nett effect rather obscure.

During period (c), however, the natural plate current flow (shown solid) is directly opposed in sense to the circulating tank current (shown dotted).

Actually the diagram is over-simplified, because the natural plate current could not possibly follow a strictly sinoidal pattern, while the plate voltage was trying independently to follow the dotted curve.

It is clear enough, however, that the continuous cyclic flow of plate current at a frequency "f" is not conducive to the generation of an output signal equal to "2f"—or any other multiple of "f".

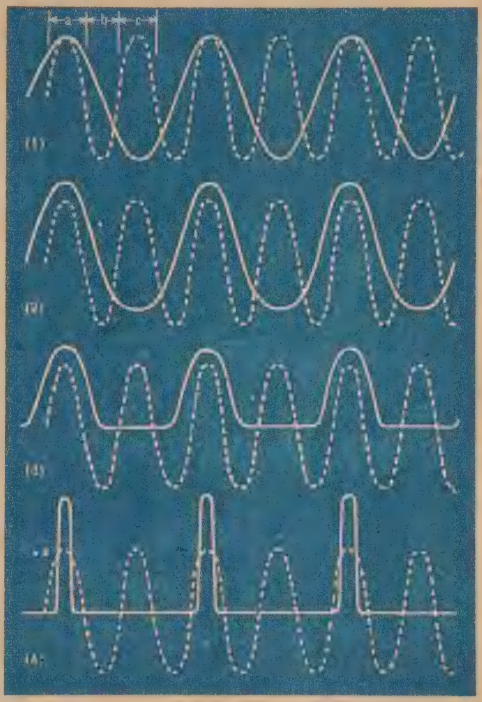
Now let's assume that the operating conditions of the associated valve are altered so that, instead of delivering a substantially sinoidal current to the plate circuit, the current pattern is distorted so that the upper peaks (on the graph) are exaggerated and the lower ones diminished in peak value.

This would be equivalent to the generation of second harmonic distortion and might be achieved by overbiasing the valve and increasing the signal grid excitation at the same time.

Now it is seen that the upward peaks of natural plate current "nudge" the upward peaks of circulating current more effectively, while there is less cancellation of the downward peaks. Efficiency as a doubler would appear to be improved.

CLASS-B AMPLIFIER

Thus encouraged, we can carry the process a step farther and visualise the valve as operated under class B conditions, with bias and input signal so arranged that plate current flows only during alternate half-cycles. This is illustrated in figure 3.



These diagrams illustrate the relationship between amplifier plate current (shown solid) and the circulating current in the output "tank" shown dotted ted. Diagrams 1-4 indicate the progress in amplifier operation from class A through to class C conditions.

It is now evident that the plate current is "nudging" the circulatory current during alternate half-cycles. There is no cancellation in the reverse direction.

In fact, during these alternate half-cycles, the plate current of the valve itself is cut off and the valve cannot exercise any limitation or restraint on the tuned circuit. The only loading evident is that presented by the following stage or by the aerial system, as the case may be.

The ultimate and practical condition is illustrated in figure 4, where the contribution of the valve to the tuned circuit is a plate current pulse of extremely high amplitude and short duration.

Such as pulse is produced by operating the associated valve under extreme class C conditions—high bias and high RF grid drive.

And here the circle ceases—the pulsed waveform which results and which makes possible effective frequency multiplication, is extremely rich in harmonics. It does what the wave in figure 1 virtually cannot do.

One important loose end is still showing. E.H. infers that he observed efficient frequency multiplication in a transmitter set up to ensure a strong fundamental and negligible harmonics.

That might be true enough of the grid drive to any given stage.

What he has forgotten is that each valve, operating as a class-C amplifier, produces a highly distorted pulsed current waveform, as in figure 4, which is capable of exciting its plate tank at the signal frequency "f", or at any small multiple of "f".

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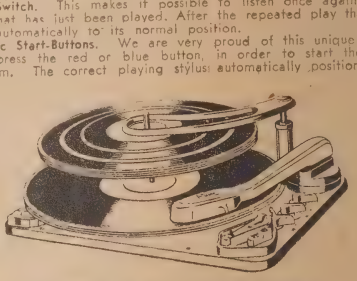
The pause switch makes possible intermissions of from 1 to 4 minutes between records. This switch permits cancellation of the pause setting at any time — even during the pause itself, or while a record is being played. The speed of the changing cycle and pause duration are completely independent of turntable speed setting.

Repeat Switch. This makes it possible to listen once again to the record that has just been played. After the repeated play the switch returns automatically to its normal position.

Automatic Start-Buttons. We are very proud of this unique design. Merely press the red or blue button, in order to start the entire mechanism. The correct playing stylus automatically positions itself.

AUTO-PLAYER 280—PRICE £26/-/6

The operation of DUAL 280 has been simplified so that it is only necessary to press one of the two starting buttons "M" or "N" to adjust the right sapphire, remove the lock of the Pickup, and start the motor. The unlocked Pickup glides to the record edge and automatically finds the running-in groove. After the record has been played right through, it returns automatically to the Pickup rest, locks in, and the motor is switched off. Should an interruption of the record be desired, it is merely necessary to once more press down one of the two starting buttons to recall the Pickup to its rest position. Further, the novel Player can be converted, with the aid of the large spindle supplied, to automatic changing ten of the popular 7in records with the large centre holes.



PRICE of DUAL 1003 £37/9/6

Players and Changers are assembled, marketed and serviced by:

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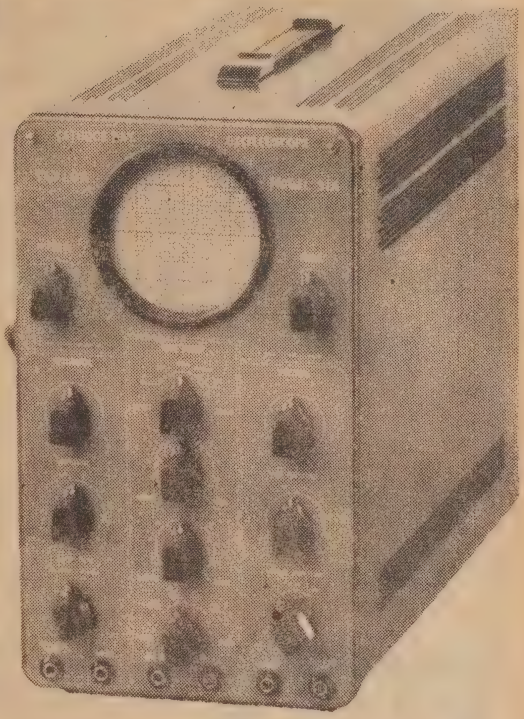
TRADE REVIEWS AND RELEASES

TAYLOR WIDE RANGE SCOPE

The Taylor 31A oscilloscope has already created considerable interest in the radio trade. It is an instrument in the lower price group but with specifications good enough to display all the waveforms likely to be of interest in the maintenance of television receivers. Anyone undertaking TV service seriously will need an instrument with performance of similar order.

PROBABLY the most significant point is the frequency response of the vertical amplifiers. This is given by the manufacturers as within plus ½ db or minus 3 db within the range 10 cps to 6 Mc.

A highly sensitive cathode ray tube assists in the achievement of good high frequency performance without excessive power supply current. The useful screen diameter is 3½in. Credit for the upper frequency response is also partly due to the video pentode valve type Z309 which is especially suitable for this type of service.



Taylor 31A oscilloscope is relatively light and easy to carry. Dimensions are 13in x 7½in x 19in and the weight 32lb. The useful screen diameter is 3½in.

COMPENSATION FILTER

A two section filter network in the plate circuit of each output valve provides frequency compensation. The filter cuts off sharply and the response at frequencies higher than 6 Mc is well down.

A pair of cathode followers in cascade is used in the input circuit both to increase the input impedance and simplify the provision of non-frequency-selective amplitude controls. Signal from the input terminals is fed to the grid of the first cathode follower. A coarse attenuator is provided in the cathode of the same valve.

The grid of the second cathode follower accepts the output from the coarse attenuator where it is passed on to a continuously variable attenuator in the cathode. The maximum input to the panel terminal for an undistorted trace is 25V rms. The input impedance is effectively 10 megohms shunted by 10 pF.

A hard valve time base permitting either repetitive or triggered operation synchronised with either internal or external signals is provided. The frequency range of the model tested is from 10 cps to 500 Kc. A horizontal amplifier is provided and has a reserve of output so that the sweep can be expanded and the instrument used to examine small portions of the wave in detail.

RETURN TRACE

Flyback suppression is provided but is only partly effective and while not important for many simple patterns does confuse the issue when viewing certain complicated waveforms. Another point of criticism is that the instrument is sensitive to pulses on the AC mains. The power mains at the test location were subject to heavy pulses due to large motors, etc., being operated and resulted in appreciable deflection of the image, particularly in a vertical direction.

The extended high tension for the cathode ray tube is obtained from the normal power supply high tension winding via a voltage tripler circuit using selenium rectifiers. The brilliance and definition of the trace are excellent.

The cost of the Taylor 31A is £120/8/6 plus sales tax. Compared with other instruments offering, this represents very good value for money.

The instrument tested was supplied by Jacoby, Mitchell & Company Pty. Ltd., 477 Kent St., Sydney.

A 20-WATT PA AMPLIFIER BY PHILIPS

TECHNICAL details of a 20-watt AC operated public address amplifier are to hand from Philips Electrical Industries Pty. Ltd.

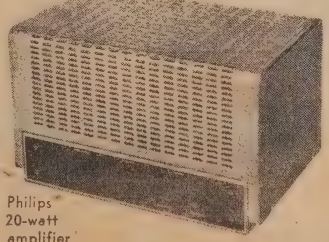
The maker's specifications state that the 20 watts is delivered at less than 5 pc harmonic distortion and that the frequency response is level between 30 cps and 15,000 cps.

Inputs are available for both microphone and pickup, the impedance presented to the microphone being 1 megohm and to the pickup .5 megohm. With the volume control at maximum the noise levels are respectively 62 db and 66 db down.

Standard valve types 12AX7 (2), EL34 (2) ad GZ32 (1) are used so that there should not be any difficulty in obtaining replacement valves should they be required.

The amplifier is housed in a metal case with grey hammertone finish the dimensions being 12 5/8in wide, 7 5/8in deep and 8in high.

Delivery is immediate and the retail price is £43/17/4 (ex tax).



Philips 20-watt amplifier

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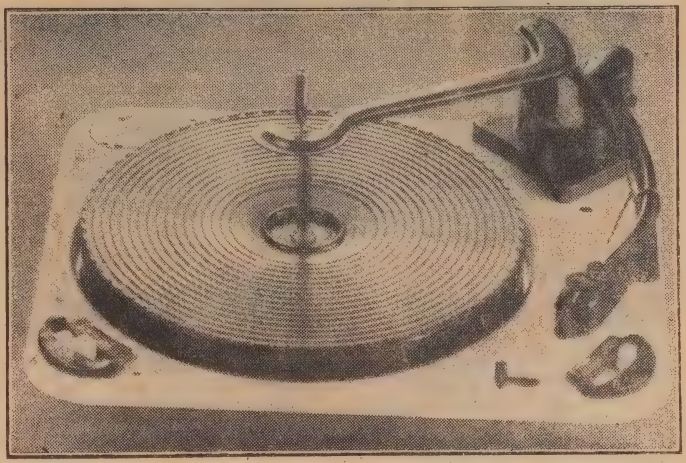
A FOUR-SPEED RECORD CHANGER FROM GARRARD

A recent addition to the Garrard range is the type RC120H four-speed record changer unit. Submitted for review by the Garrard Engineering and Manufacturing Co. Ltd. this unit embodies a number of features usually found only in more expensive models.



The RC120H four-speed record changer is designed for easy mounting in radiogram or record player units.

THE RC120H is finished in cream and brown, and is particularly neat. reamlined in appearance it looks well ough to grace any type of cabinet. performance compares very favorly with others in its class.

The motor is a small but powerful aded-pole induction type, fitted with a ndle turned down to four stepped meters. The spindle engages an idler eel which in turn drives the outside n of the turntable at any one of four eeds—16, 33, 45 or 78 rpm.

An attractive feature is a speed variain of plus or minus 2 pc, on all four eeds.

Motor vibration is suppressed by tue of mounting the motor to the base rough a rubber supported plate. The anger mechanism is of a very robust nstruction and should give trouble e service under normal operating nditions.

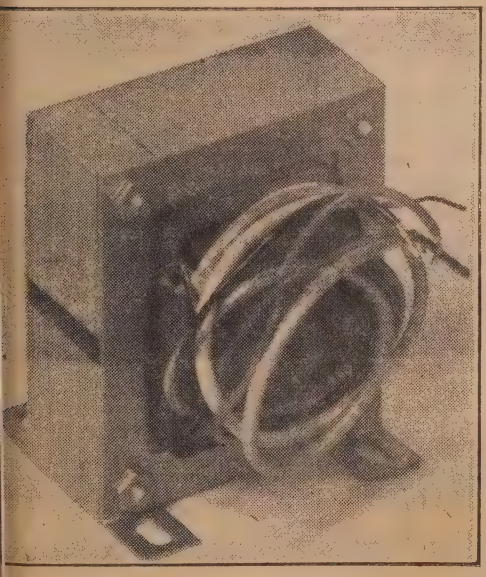
A grooved rubber pad is fitted to the ntable which is of a heavy cast metal. The pickup has a number of adjustle features. Pickup weight may be ried by means of a knurled screw at e rear of the arm. The pickup set wn position is also adjustable and may varied by means of a screw, located ar the pickup base.

The pickup height represented by the number of records that the pickup will clear is likewise adjustable.

On test the response of the pickup proved typical of such units. Feeding a number of cartridges into a 1 meg load, the response on microgroove was sustained from 100 c/s to about 10 Kc with a rise at about 6 Kc and a gradual tapering off at either end.

The RC120H will play records of all diameters. It is, however, a non-mixer. An instruction booklet covering the various adjustments and other data is supplied with the unit.

RAME OUTPUT TRANSFORMER BY FERGUSON



Ferguson Transformers Pty. Ltd. have produced a frame output transformer suitable for Australian standards. The transformer was, in fact, designed to meet the requirements of the Australian television receiver described in the May issue of R, TV & H but obviously it would be suitable for many other designs.

NEW RANGE OF IRC RESISTORS

Information is to hand from Wm. J. McLellan & Co. Pty. Ltd. regarding a new I.R.C. flat wire wound resistor type FRW.

INTERESTING features of the new resistors are the high ratio of power dissipation to space occupied and the ease with which the resistors may be mounted either horizontally or vertically.

Type FRW is a flat wire wound resistor with the resistance element wound over a non-hygroscopic ceramic form with copper-nickel or nickel-chrome alloys as required.

The element is coated to insure long life at normal load and in the presence of moisture, two types of coatings being available. Type "B" coating is designed for high temperature operation and allows the final temperature to be as high as 300 degrees C. Type "C" coating behaves better under extremely humid conditions as may be encountered aboard ship but only allows the temperature to be taken up to 160 degrees C.

In terms of power dissipation ratings this means that the FRW-24 which has an overall length of 7¼in is able to dissipate up to 75 watts with the "B" coat and 30 watts with the "C" coat. Resistances up to .1 meg are available with the max. resistance decreasing with the smaller sizes.

Type FRW-20 has an overall length of 2¼in and is able to dissipate 20 watts in the case of the "B" coating or 8 watts when supplied with the "C" coating. The maximum resistance when wound with .0015 in diam wire is 10,000 ohms.

Adjustable units are available under the type No FRWA. The element is exposed at the edge of the former and contact made by means of a metal band. Since part of the element is exposed the same proof against humidity cannot be expected as with the other types.

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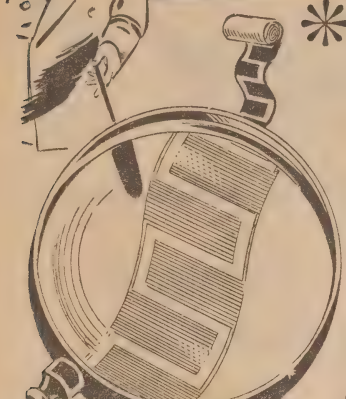

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In the Microcap capacitor the wire pigtail leads are soldered directly to the capacitor unit

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NEW BOOKS

One for the sound men

PUBLIC ADDRESS AND SOU DISTRIBUTION HANDBOOK by J. Walker. Stiff cover. Price (appr 34/9 plus 1/3 postage.

This would appear to be a very wo while handbook for anyone specia ing in sound distribution systems, ticularly large permanent installati in factories, churches, theatres, Although based on English conditi and the use of English equipment still contains much valuable mate which is just as applicable in this co try.

Containing 160 pages, it devotes first chapter to the principles of so amplification, commencing with operation of the valve and finish with a discussion on high fidelity quirements.

The chapter on equipment which lows covers a wide variety of typ items, including the latest in sound lay equipment for large area insta tions.

There is a chapter on installat covering such diverse items as po output requirements and long dista relays over PMG lines. This is lowed by a description of typical stallations in hospitals, sports grou airports, theatres, &c., finishing a discussion of stereophonic sound. ally there is a chapter on maintena and a couple of useful appendices.

Our copy from Technical Book Magazine Company, 295-297-299 Sw ston St., Melbourne.

All about short waves

WORLD RADIO HANDBO (published and edited by O. Lund Joh sen),

A query which turns up regularly our mail, particularly from New Aus lians, concerns the frequency, tr mission times, &c., of overseas s wave stations. While served in part our Short-Wave Notes, it is clearly possible to provide all the informa likely to be of use to such readers.

The World Radio Handbook sho be the answer to this problem. C taining 168 pages, it lists virtually ev country and every outlet likely to of interest to the short-wave liste In fact, it appears to be a good more complete than that, if the c pleteness with which it covers the A tralian radio system is any indicat National and commercial broad stations, local and overseas short-w services and even the local FM ch nels are listed along with times of tr mission, frequency and power. The s appears to apply to all other countr

In addition, there is much other ful and interesting information for short-wave listener. Photographs descriptions of stations and person

addresses, time charts, text of announcements, tables of language lessons, &c., which are designed to make short-wave listening an even more interesting and instructive hobby.

Our copy from Stanley Young Sydney Pty. Ltd., 124 Bathurst St., Sydney. Price 17/6 plus 1/- postage.

First in a new field

TRANSISTORS HANDBOOK by William D. Bevitt. Transistor Applications Engineer CBS-Hytron. Hard cover, 8¾in by 5¾in, 410 pages, published by Prentice-Hall Inc., NJ, USA, 1956 Price in the USA approx. 9 dollars.

With experimenters and engineers alike thirsting for easily absorbable knowledge relating to this new field, a book written from the practical point of view, yet with full authority, will be very welcome. It is claimed as the first book of its kind dealing with transistors.

FOR PRACTICAL MAN

Transistors Handbook does not seek to cover the physical fundamentals of transistor theory from basic quantum mechanics nor does it deal with the design of transistors. Rather it is written to inform the practical radioman how he may effectively make use of available transistors. Many of the transistor types mentioned in the practical illustrations have close equivalents which are readily available in this country.

The introductory chapters deal with the fundamental ideas of insulators, conductors and semiconductors, leading on to discussions of point-contact transistors and junction transistors, as well as special transistors for high powered and high frequency use.

These general chapters lead naturally to a discussion of particular transistor characteristics. Noise, temperature effects, the need for bias stabilisation as well as special considerations in audio preamplifiers, power amplifiers, radio frequency amplifiers, oscillators and computers all receive due emphasis.

The author mentions circuits which have no parallel in valve technique. For example, the complementary symmetry class-B push-pull amplifier does not require a transformer or phase inverter, yet offers all the advantages of the familiar class-B valve amplifier.

CIRCUIT SECTION

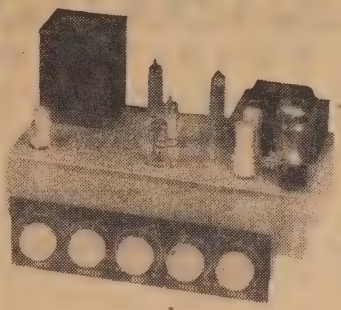
A popular part of the book will be the chapter giving practical circuits with values of components. Among the projects described are a transistor microammeter, a megohmmeter, a bridge null detector, a grid dip meter and a hearing aid.

The simple circuitry allows most of these to be constructed with little effort and serve a worthwhile purpose if only to give the first hand experience necessary to build up familiarity with transistor peculiarities.

At the other end of the scale, several fully engineered projects, among them a receiver employing 11 transistors, give an indication of the future importance of transistors in the world of electronics.

A welcome feature of the book is the list of references at the end of each chapter. These include popular maga-

HI-FI AUDIO, COMPLETE RANGE



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Response: 10 Cycles to 20 KCs Flat.
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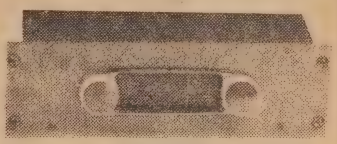
When ordering, please specify output impedance of amplifier required.
All prices exclude freight.

STANDARD MULLARD 5/10.
Single Chassis Amplifier Still
£25/10/-



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Heavy Duty 8lb turntable. Low Wow and Rumble. A frequency response check made with the transcription pick-up on the (Decca LXT2695) test record showed a smooth response within 3db from 40-15,000 cps. The pick-up would suit the Mullard 5-10. etc. as no compensation is required for LP records.
Collaro 2010 Complete Player .. £31/2/6
Collaro 2010 less Pick-up £26/7/6
Collaro Transcription Pick-up .. £5/15/-
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Your worn sapphire could damage those valuable recordings so replace the styli now. Replacements for all pick-ups post free.

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1Q5GT	7/6 ea.	6V6G	12/6 ea.	955	5/6 ea.
2X2	12/6 ea.	6AK5	17/6 ea.	866	17/6 ea.
3S4	12/- ea.	12H6	7/6 ea.	AV11	5/- ea.
5Z3G	12/6 ea.	12SK7	10/6 ea.	801A	25/- ea.
6AM5	17/6 ea.	EF36	10/6 ea.	803	40/- ea.
6AC7	3/11 ea.	VR65A	2/6 ea.	815	45/- ea.
6AG7	10/6 ea.	VR105/30	10/6 ea.	813	40/- ea.
6B4G	12/6 ea.	VR106	12/6 ea.	837	25/- ea.
6C6G	7/6 ea.	VT109	12/6 ea.	807	12/6 ea.
6C8G	5/- ea.	VT75	12/6 ea.	5CP1	50/- ea.
6F8G	12/6 ea.	7193,		VCR97	39/6 ea.
6G6G	12/6 ea.	2C22	2/11 ea.	EF50 sockets	3/6
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zine articles as well as original papers n professional journals and will be of assistance to readers whose interest is aroused to seek more detail on particular topics. Our copy direct from the publishers (MVF).

Sound in the home

HI-FI LOUDSPEAKERS AND ENCLOSURES, by Abraham B. Cohen. Stiff paper cover, 360 pages. Published by John F. Rider, publication No. 176.

The writer of this book, A. B. Cohen, is at present the Engineering Manager of University Loudspeakers Inc. He has had long experience in the fields of broadcasting, music and loudspeaker design and has a BEE degree.

Cohen's book is written primarily for the high fidelity enthusiast and is non-mathematical in its approach to the subject. While there is a good deal of elementary material in the book, the treatment is not by any means superficial and the average hi-fi enthusiast should be able to read it with a great deal of pleasure and profit.

The book is divided into three main sections, namely "The Loudspeaker", "The Enclosure" and "The Room".

The first section, comprising seven chapters, begins with an elementary explanation of sound and how the loudspeaker works, progressing through the mechanics of hi-fi loudspeaker design to multiple speakers, networks and the major loudspeaker characteristics.

The second major section discusses the more important types of speaker enclosure, their merits and characteristics and how they are constructed.

Then, four chapters are devoted to the listening room and its relationship to the enclosure, the listener and the music.

Finally, in an appendix at the back of the book are condensed, plans for 8 enclosure types, suitable for home construction. . American price quoted for the book is four dollars 60 cents. (WNW).

Five on transistors

TRANSISTOR ELECTRONICS, by Lo, Endres, Zawels, Waldhaurer & Cheng of RCA Laboratories. Hard cover 8½in by 5½in, 520 pages, published by Prentice-Hall Inc., NJ, USA, 3rd printing March, 1956.

The combined work of five specialists on transistors, the book is a detailed study of the physical concepts and characteristics of transistors from an engineering point of view.

The idea of "duality" is mentioned but the emphasis is on a fundamental understanding of transistors for their own sake. We were particularly impressed with the chapter on direct current bias circuits which we feel will be for many engineers, already familiar with valves, a natural point of entry to transistor techniques.

The book assumes some mathematical maturity being directed at advanced undergraduate students in electrical or communications engineering and this background is necessary for it to be of full value. We predict that it will soon be accepted as one of the standard reference books on transistor engineering (MVF).

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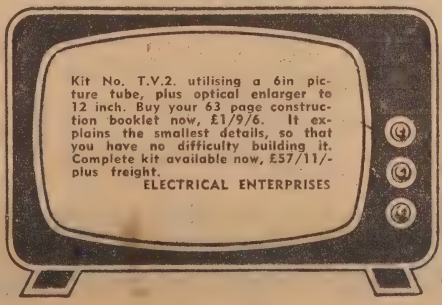
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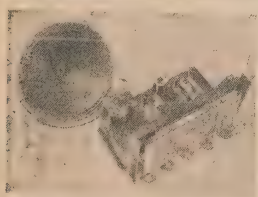

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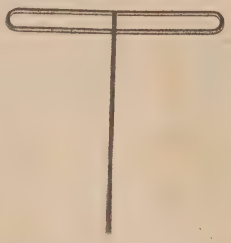

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Grid 1	— 50 volts
Diameter	90mm
X Plate Sensitivity	— 14
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Anode 3	1200 volts

Electro-static deflection
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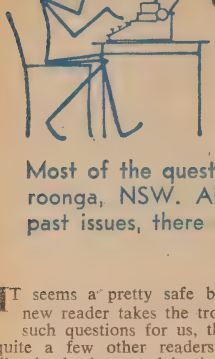


Here's your answer, Tom!

Most of the questions for this month's "Answer Tom" article came from a reader in Wahroonga, NSW. Although several of these have been dealt with, in one form or another, in past issues, there is always the man who "has just started out" and raises the very same queries all over again.

IT seems a pretty safe bet that, if a new reader takes the trouble to pose such questions for us, there must be quite a few other readers who would likewise be interested in the answers.

So here goes, Tom!

Please explain the meaning of phase rotation.

To understand the meaning of phase rotation, Tom, it is necessary, first, to understand the meaning of phase.

Basically, phase means a comparative time of occurrence, as applied to related actions, changes or events.

If two actions or changes occur at the same instant, we may say that they are in phase. If one occurs before or after the other, we might say there is a phase difference between them.

As applied to electricity, phase usually denotes a comparison between the changes in two or more different voltages, two or more different currents, or between the voltage and current in a particular circuit.

In its time sense, phase implies some relation to the standard AC cycle of 360 degrees. Current and/or voltages, which take a different time to reach their respective maxima, are said to be out of phase.

The amount by which currents and/or voltages are out of phase is defined in degrees, and this is referred to as the phase angle. If, for example, the current in an alternating circuit lags behind the voltage by a quarter of the time required for the complete cycle, the phase angle is one-quarter of 360, or 90, degrees.

The term "phase reversal" usually implies a phase difference of 180 degrees.

How is it that the current in a valve is not short-circuited to earth when the suppressor or cathode (sometimes both) are directly earthed?

We can well imagine your perplexity in trying to fathom out that one, Tom. In order to help you to grasp the situation, it will again be necessary to repeat a few fundamentals.

As you may well know, it is necessary to have a complete circuit in order to have any current flow at all.

In a receiver or amplifier the chassis forms part of the circuit, being normally at earth potential. It is usually negative with respect to the high-tension line and the various plate circuits.

Now, electron flow in a valve is from cathode to plate, and electron flow is really just another name for current flow.

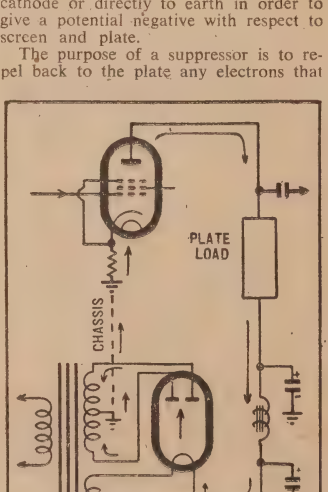
In a typical circuit, electron movement continues from the plate circuit to the high-tension line, then through the filter and power supply to chassis. (See diagram.)

The circuit is therefore completed and it is seen that the chassis is just one part of the complete circulating path which the electrons follow. There has to be a link between chassis and cathode, the connection being a direct one in some cases or through a bias resistor in others.

It isn't a question, therefore, of the cathode being "shorted to earth". The chassis-to-cathode link is an essential part of the circuit.

The suppressor is connected to the cathode or directly to earth in order to give a potential negative with respect to screen and plate.

The purpose of a suppressor is to repel back to the plate any electrons that



Illustrating the path which the electrons follow in a typical circuit involving an amplifier valve and an AC power supply. Note that the chassis is part of the whole circuit.

may have been dislodged from it by reason of the bombardment of the plate by the electron stream. It also slows down the electron stream, thereby decreasing the bombardment of the plate to very small proportions.

However, Tom, the suppressor grid isn't fine enough in its pitch to impa seriously the flow of electrons throu the valve. It orders and controls th movement, but cannot, in any sense, regarded as "short-circuiting" the fl of current.

What is a Pierce Oscillator?

A Pierce oscillator is a particular ty of oscillator which is crystal-tuned. U is made of capacitive feedback, fro plate to grid, in order to sustain oscil tion. The frequency of oscillation is d termined by the crystal, which is in t feedback network.

Perhaps the easiest way to expla it, Tom, is to resort to a circuit, whi is reproduced herewith. As you c see, it is a very simple arrangeme which allows the oscillator to operate a number of spot frequencies simply switching in different crystals.

I have noticed a mistake in the three-valve reaction set described in May, 1956. In the circuit diagram, pin 4 of the rectifier is connected to pin 3 on the speaker socket. This is also mentioned in the text, but in the wiring diagram pin 1 on the rectifier socket is connected to pin 3 on the speaker socket. Does it matter which way it is, seeing it is just a filament and the two pins are connected to the one electrode in the valve?

No, Tom, it does not matter fro which end of the filament the HT taken. As you have said in the lat part of your question, the two pins a connected to each end of the one el trode within the valve, namely, the fi ment. Because of the operation of t rectifier, the filament as a whole is po tive with respect to chassis.

It would have been more consiste on our part to show the HT connecti to a particular end of the filament, b it is really immaterial.

What is an Endodyne?

An endodyne, Tom, is a synonym f autodyne. This is a system wherein simple valve, usually a pentode, is us both as a mixer and a generator of loc oscillation in a superhet receiver.

Autodyne frequency changers we widely used in broadcast receivers b fore the introduction of pentagrid co verters and the still more modern triod hexodes, etc.

They are finding fresh application some VHF receivers and tuners.

For autodyne service, the valve made to oscillate by wiring a tuned fee

k circuit into its normal plate, grid cathode circuits, much like an ordin- regenerative detector.

At the same time, the incoming signal ed to the grid.

The difference between the signal-frenc and the frequency of oscillation ults in what is referred to as the t (or "intermediate") frequency.

This intermediate frequency is then fed an IF amplifier, in the same manner in modern superheterodyne receivers today.

Various autodyne circuits have been igned, but the basic idea remains the ne.

Could you please explain the meaning of remote cut-off and sharp cut-off.

Remote cut-off and sharp cut-off, Tom, terms normally used to differentiate ween pentode RF amplifier valves. ey refer to the order of voltage it is essary to apply to the grid to cause e current cut-off.

This is quite an important character-c, because it is common practice to y the amplification of an RF pentode varying the grid bias.

Unless special measures are adopted, reasing the bias beyond a certain fig- causes the plate current suddenly to cut off. Any input signal fed to the ve under these conditions is seriously orted.

To overcome this, a value with a vari-e-mu characteristic has been deve-ed. The grid is so constructed that pitch is varied along its length.

As the bias is increased, electron flow gradually reduced until the electrons only pass through the wider-spaced tion of the grid.

As a result, large values of negative s may be applied without complete c current cut-off.

Consequently, a remote cut-off valve ows a very smooth control over gain be achieved and avoids serious dis-tion when the valve is operating with plate current.

I am a beginner in radio and am thinking of building the "Little General" for 1956. However, I would like to receive short wave as well as broadcast. Could the "Little General" circuit be modified to do this, if so, how?

Well, Tom, theoretically the "Little neral", or for that matter any other can be modified to receive short ves.

In practice it is a different story, uming that you wish to retain the sting chassis.

If you want a set to receive short ves, Tom, you must provide a set of ls which will tune to the required rt-wave band. Moreover, some form switching, from one band to the other, st be incorporated.

These facilities take up space and re is not a great deal of this to spare the chassis of the "Little General", ugh we wouldn't say that the scheme impractical.

A receiver designed with dual-wave eration in mind would be laid out accommodate the extra components l the extra knob which would norm-be required on the front of the set.

In wiring a set which leads should be kept short, and why?

Any leads carrying high frequency signals should be kept short, Tom. Generally the layout of a well-designed receiver is planned so that these leads may be kept short.

However, many beginners still manage to get themselves into bother by draping these leads all over the chassis in a very untidy manner.

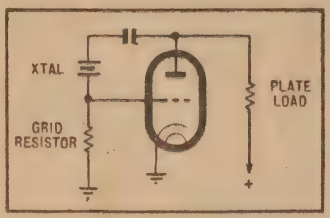
The cause of this is generally an incorrect orientation of valve sockets, coils and IF transformers.

Valve sockets, coils and IF transformers should be so placed that the connections between the various "grid" and "plate" pins are as short as possible.

The general practice is to wire in all the important wires and components first, the less important ones being then fitted neatly into the remaining space.

The reason behind keeping leads carrying high frequency signals as short as possible, is to minimise interaction between them.

If a grid lead of one stage is run very close to the plate of a later stage, interaction will take place and some signal energy will be fed back to the preceding grid.



The basic circuit of a Pierce type oscillator. Its output frequency is determined by the crystal, no coils being necessary for its operation.

This interaction may well produce positive feedback and may cause oscillation.

Another point that many beginners overlook is that the centre spigot on miniature valve sockets is really a shield and should be earthed.

Failure to earth these will result in positive feedback from plate to grid, through the capacity effect between pins.

We generally make a point of mentioning these pitfalls in our constructional articles. So, Tom, if you are considering tackling one of our designs, we suggest that you read carefully through the article. Then study the under-chassis photographs and wiring diagram very thoroughly, before attempting the actual construction.

Why are some resistors wire-wound and others carbon?

You will notice, Tom, that wire-wound resistors are available in low values only, to be specific, up to a few thousand ohms. This is due to the fact that, in order to make a wire-wound resistor of a high value, a large quantity of very fine wire would be required. This would make the finished resistor both bulky and costly. Carbon resistors, however, can be made in very high values at a relatively low cost. This is achieved by varying the quantity of carbon used, which actually becomes less as the resistance is increased.

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Symbolic of the hope we hold that TV will spread tolerance and enlightenment through the world is this fine picture of the London TV Services' new aerial at Crystal Palace. It is 640 feet high.

AUSTRALIAN TV STANDARDS

World television standards are almost as varied as Australian railway gauges. The television service being introduced into this country now is different from the system used in England and different again from the American system. A working knowledge of the local standards and their implications in receiver design is vital to television set builders and servicemen.

by Maurice Findlay

THE majority of our readers will now be familiar with the process by which a television picture is built up on the fluorescent screen of a cathode ray tube. Briefly, the electron beam from the cathode is made to focus to a sharp spot at the screen and this spot is deflected either by electric or magnetic fields to form a pattern of closely spaced lines.

CARTESIAN SYSTEM

There are other possible ways of constructing a picture but all of the currently accepted systems make use of two generators of sawtooth waveform which operate on the spot in directions at right angles.

The convention is that while the horizontal deflection system is moving the spot at a high velocity simultaneous movement is taking place in a vertical direction at a relatively low velocity. The action of the two oscillators is to build up a pattern of horizontal lines, the number of lines being equal to the ratio of the frequency of the two oscillators.

This ratio is one of the most significant factors in a television standard because it governs the detail into which a picture can be resolved in a vertical direction. It is worth spending a moment to discuss a typical basis on which a satisfactory figure may be determined.

Any figures ultimately depend on psychological factors. These in turn are modified by consideration of cost so that a variation in independent figures is to be expected.

For a given picture size, there is an optimum viewing distance below which the entire picture cannot be viewed at the one time and above which the picture seems too small. Having minor to the shape of a television screen, the optimum viewing distance is from 4 to 10 times the height of the picture.

The acuity of the average human eye is such that with a viewing distance of 5 picture heights it can just resolve about 580 lines and therefore on this basis alone there would be no point in complicating the system by having a greater number of lines.

BRITISH SYSTEM

It is of value to compare this figure with the number of lines used in television systems currently in use in other parts of the world. The United Kingdom uses 405 lines, the main reason being it was the first of the present television systems to be used and, when it was planned, circuit techniques had not advanced to the stage where greater resolution could reasonably be used.

The current system in the America uses a total of 525 lines. It was considered desirable to use a picture repetition frequency related to the frequency of the power mains and this number of lines makes good use of the channel widths available. It replaces a 441 line system used earlier.

France is using a 819 line standard

with the object of obtaining very good resolution. If the full potentialities of the system are realised it can do this very well, but it has the disadvantages that a very wide frequency bandwidth is required and therefore that it must necessarily be used at higher frequencies than other systems.

CCIR 625 LINE

The remaining important standard is known as the CCIR ("Comite Consultatif International des Radiocommunications") standard and uses 525 lines. As well as being the standard in use here, it is used in Sweden, Switzerland, the Netherlands, Italy, Denmark and Belgium, the last with some modifications.

The apparently random number of lines do have a sound practical basis. They are, in fact, chosen so that the line and picture synchronising signals can be derived from a single standard frequency source with the frequency multipliers or dividers in simple ratios. The number 405 is equal to 5 x 3 x 3 x 3 x 3, and 625 is equal to 5 x 5 x 5 x 5.

After lengthy and detailed technical deliberations the C.C.I.R. recommended that the 625 line standard, with other details generally similar to the American system, be adopted as a world standard. The Australian Broadcasting Control Board, after an extensive study of local conditions, eventually decided that this standard would best meet the needs of this country.

Some of the lines are occupied with synchronising signals but, at the same time, the 625 line system permits the degree of resolution calculated on the basis of minimum viewing distance and human eye characteristics as before.

MINIMUM FREQUENCY

In order to give the impression of movement without jerks or flicker, the entire picture information must be transmitted and another picture follow within a certain minimum time. This time can be made longer and so save on bandwidth if a system of interlaced scanning is used.

By running the vertical deflection system at twice the picture repetition frequency and choosing an odd number of lines, the spot can be made to scan lines 1, 3, 5, &c., first and then return to the top of the picture to fill in lines 2, 4, 6, &c. Provided the picture is not viewed too closely, the eye is deceived into believing that it is repeated at double the actual frequency.

The time-established moving film picture repetition frequency is 24 per second, with each picture double exposed to prevent flicker. Television standards in various parts of the world specify picture repetition frequencies of 25 per second and 30 per second, depending on the frequency of the power mains.

The reason for this is that a simple relation between the picture repetition frequency and any hum which may appear in receiver circuits due to insufficient filtering is less objectionable than with some random relationship.

Recent experience has shown that satisfactory filtering in receiver circuits can be obtained economically, even when the picture reception frequency, or the field frequency (picture frequency x 2), is not synchronised with the mains, provided that it is fairly close.

The Australian standards specify that the field frequency shall be 50 cps, non-synchronous with the power mains, and held within a tolerance of 0.1 pc.

This choice was made for the reasons that it allows satisfactory reception when transmitter and receiver are operated from different power supply systems, but at the same time permits a substantial saving on filtering than if, say, a field frequency of 48 cps had been used.

Having established the picture repetition frequency, the number of lines, and the system of interlace, a raster can be set up on the screen. By varying the intensity of the light spot as it traces out the raster, the picture can be formed.

In order to preserve detail in a horizontal direction, the intensity of the electron beam must be able to vary in an extremely short time. The highest frequency components required to be present can be estimated.

It is necessary to assume that equal horizontal and vertical resolution will be

INTERLACED SCANNING SYSTEM

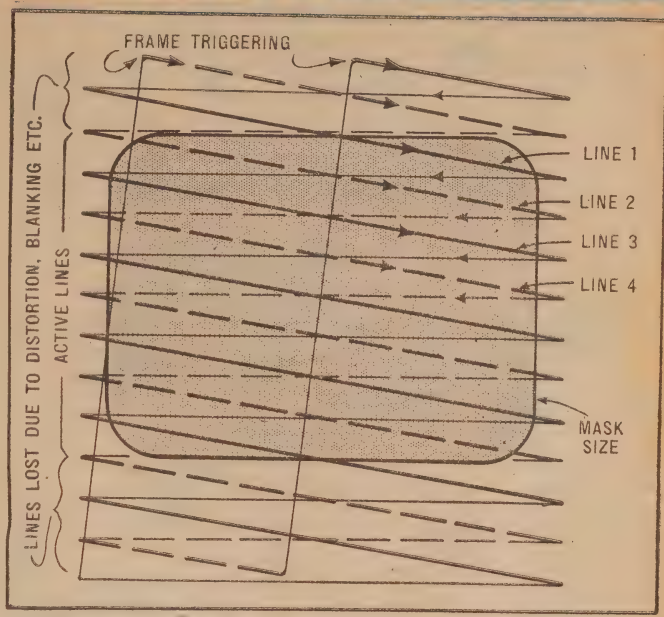

Figure 1. The path traced out by the electron beam when an interlaced scanning system is used. Compared with the alternative of scanning straight from top to bottom of the picture, this method requires less bandwidth for a given amount of flicker.

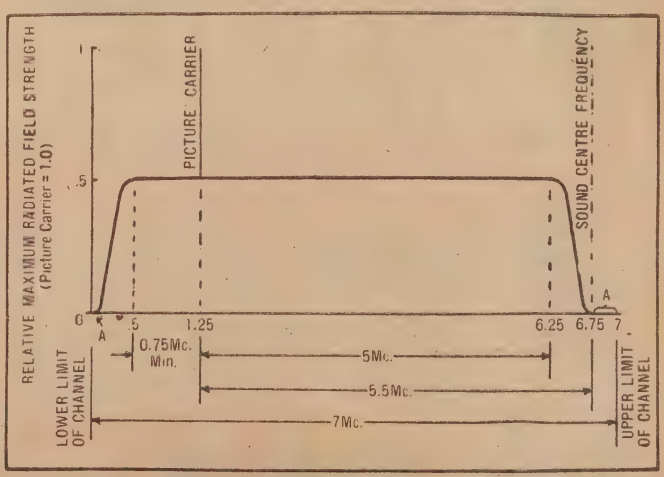

Figure 2. The standard Australian Television channel. The curve indicates the relative field strength of the picture modulation within the band. Video components up to 5 Mc are transmitted in the upper sideband without attenuation.

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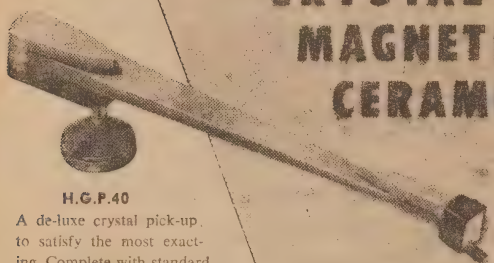

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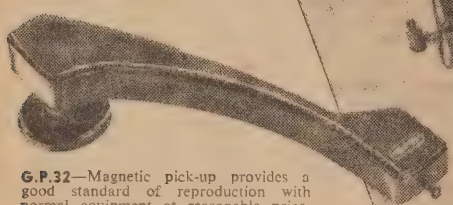

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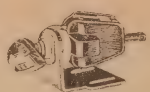

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obtained if the electron beam is able to change from maximum white to black in the same distance as there is between lines.

The universally accepted ratio of picture width to height is 4 to 3 and if the distance between the centre of the white and the centre of the black at line spacing is a half-wavelength, then the basic frequency component is 25 x 625 x 625 x 4/3 x 1/2 cycles per second. This works out to about 6.5 Mc.

Practical experiments have shown that equal vertical and horizontal resolution can be obtained with less than this. Depending on the type of picture, a typical figure is about 5 Mc.

Therefore, to transmit a 625-line picture with equal horizontal and vertical resolution, the modulation of the transmitter would need to contain components up to about 5 Mc.

If the ordinary simple amplitude modulation system were used, a total bandwidth of 10 Mc would be needed to transmit all the information.

SUPPRESSED SIDEBAND

A more economical method would be to suppress one of the sidebands completely. The total channel width for the video signal would then be only 5 Mc, assuming the amplitude modulation system which is, in fact, used.

However, for true single sideband, extremely complicated and expensive equipment would be required at the transmitter, and at this stage of the development of television such a system could not be considered seriously.

A saving in channel width only slightly less than with single sideband can be achieved by attenuating one sideband with a relatively simple filter, when the system becomes what is known as

THE RECTIFIED VIDEO OUTPUT

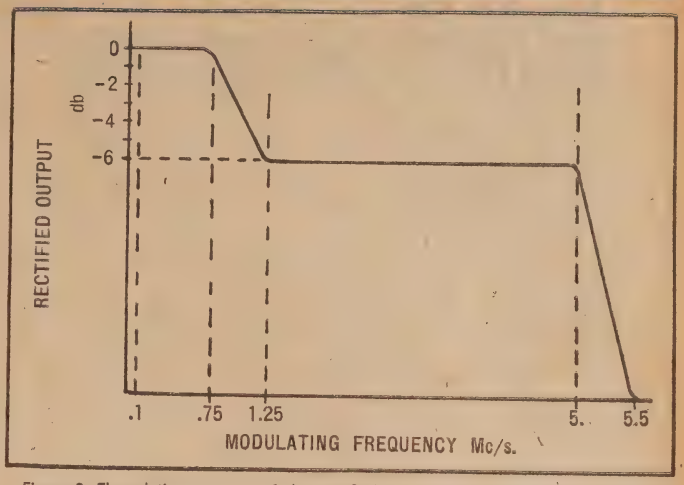

Figure 3. The relative response of the rectified video signal is shown in this curve. Low frequency video components appear at greater amplitude than the remainder due to the presence of the low frequency sideband as shown in Figure 2. This distortion is corrected by receiver alignment.

rectifier output level at all frequencies. The oscillogram on Page 48 of this issue shows the practical sloping characteristic on the right-hand side which has the desired response. (The subject was discussed also in last month's "Course In Television".)

The sound channel which accompanies the picture has yet to be mentioned.

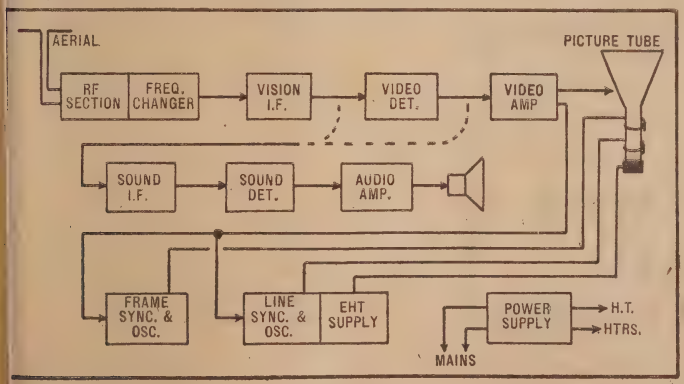

Figure 4. A block diagram showing the essentials of a TV receiver. It is necessary that the RF and IF channels have special response curves if an undistorted picture is required.

estigial sideband.

In terms of receiver design, the vestigial sideband system means that the receiver response characteristic must be filtered to correct the distortion which occurs in the detected signal due to the presence of both sidebands at lower frequencies.

The rectifier signal without correction is as shown in Figure 3, assuming that there is no distortion due to bandwidth before detection.

The receiver frequency response characteristic must be modified to make the

Amplitude modulation is used in the United Kingdom 405-line system and also in the French system, but there are very definite advantages in using frequency modulation.

These will become more evident later in this discussion, but briefly FM offers improved signal-to-noise ratio and the possibility of simplifying the receiver by making use of the heterodyne beat between the picture and sound-carriers. This simplificatiton is known as inter-carrier reception.

The improvement in signal-to-noise ratio with FM sound is only fully realised if the deviation for full modulation is high. This, of course, requires a large channel width and a compromise between the ideal and what can reasonably be achieved practically must be reached.

Many high fidelity FM broadcast stations use a maximum deviation of 75Kc, while, for communication work, where the channel width is at a premium, the maximum deviation may be as low as 15 Kc. The Australian standards call for a deviation of up to 50 Kc and, while being fairly economical in terms of bandwidth, at the same time permit good noise rejection and quality to be achieved.

OFFICIAL STANDARDS

From what has gone before you will have been reminded of the inherent complexity of a television signal compared with the relatively simple amplitude modulated signals to which most of us have been accustomed.

At this stage it is well worth reviewing what we have said by quoting the ABC Board's official standards.

SCANNING SPECIFICATIONS

Number of Lines and Interlacing—

The standard number of scanning lines per picture shall be 625 interlaced two to one. The radiated signal shall be monochrome.

Picture and Field Frequencies—

The picture frequency of the radiated signal shall be 25 per second and the field frequency shall be 50 per second non-synchronous with the power mains supply and held within a tolerance of plus or minus 0.1 pc.

Aspect Ratio—

The standard aspect ratio of the transmitted television picture shall be 4 units horizontally to 3 units vertically.

Scanning Order—

During active scanning intervals, the scene shall be scanned from left to right horizontally and from top to bottom vertically at uniform velocities.

The official definition of the standard

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Australian television channel should also be noted, bearing in mind what we have already said regarding the requirements for the transmission of detailed picture information. Again we quote.

THE TELEVISION CHANNELS.

Channel Width—

The width of the standard television channel shall be 7 megacycles per second.

Location of the transmitted carriers within the Channel—

The unmodulated sound carrier shall be 0.25 megacycles per second below the upper limit of the channel and the picture carrier 1.25 megacycles per second above the lower limit, so that the carriers are spaced 5.5 megacycles per second apart.

Picture Transmission Amplitude Characteristic—

Vestigial sideband transmission shall be used, and the maximum amplitude versus frequency characteristic of the radiated picture signal shall be as shown in the drawing attached to the standards.

The drawing mentioned gives the information which appears in Figure 2 of this article.

Taking the reference frequency as the lower limit of the channel the picture carrier is placed at 1.25 Mc and the sound carrier at 6.75 Mc. The picture and sound carriers, therefore, are separated by 5.5 Mc. The picture carrier strength is shown as 1 and the relative strength of the sidebands at various frequencies indicated on the vertical scale.

Note that the sidebands are reduced to a very small amplitude before the edge of the channel at the low frequency end and before the FM channel is reached at the high frequency end.

Refer now to Figure 4 which is a block diagram of a representative television receiver.

The wide bandwidth of the television signal implies that the RF and frequency changer sections must be able to pass the full 7 Mc.

The sound could be separated from the picture information after the frequency changer but it is more usual to use the inter-carrier reception in this country, in which case the vision intermediate frequency amplifier must also be able to transmit the full bandwidth.

At the vidéo detector there will appear a rectified signal which will contain components from very low frequencies up to 5 Mc, plus the 5.5 Mc beat between the sound and picture carriers.

This 5.5 Mc beat will incorporate both the frequency modulation which appears on the sound carrier and the amplitude modulation which appears on the picture carrier.

SOUND CHANNEL

The amplitude modulation can easily be removed by passing the 5.5 Mc signal into a tuned channel with a set of limiters. It can then be passed on to some form of frequency modulation detector and thence to the audio amplifier and loudspeaker.

If this system is to be completely successful, the frequency variation of the picture transmitter carrier with modulation must be very low, otherwise noise will appear on the sound. The official specifications state that the frequency shift of the picture transmitter carrier must be small enough to allow the inter-carrier sound system to be used.

It is interesting to note the specific standards for the quality of the sound hannel. Again we quote.

OUND SIGNAL MODULATION

ype of Modulation—

Frequency modulation shall be used r the television sound transmission.

lodulation Band and Pre-emphasis haracteristic—

The transmitter shall be capable of perating with modulation frequencies tween 30 cycles per second and 15,000 cles per second.

Pre-emphasis shall be employed in the und transmitter in accordance with the pedance-frequency characteristic of a ries inductance resistance network ving a time constant of 50 micro conds.

requency Deviation—

In the sound transmitter, the deviation r full modulation shall be plus or minus kilocycles per second.

Note the mention of pre-emphasis in specification. The audio in the transtter is treated by an inductance sistance network which causes the odulation to increase with frequency.

ELATIVE ENERGY

High frequency components in normal eech and musical signals decrease with creasing frequency so that there is little elihood of overloading the system beise of the relative high frequency inease. Because they do decrease with quency, the high frequency componis are at a disadvantage with regard to se introduced in the system.

If a corresponding de-emphasis netrk is placed in the receiver, the noise mponents are reduced but the sound mponents are merely brought back to a normal relative amplitude.

Thus by taking advantage of the fact t the noise component has a higher erage frequency and lower average amude than the required signal componn, an overall improvement in signaloise ratio can be obtained.

The high frequency boost in the transter is obtained by means of a resisce inductance network and the corrending high frequency attenuation in receiver by means of a resistance acitance network.

ME CONSTANT

n order to avoid the need for specifythe exact values of the components, ch would vary for different impedance ls, it is usual merely to state the e constant—whether it be a pre-emsis or a de-emphasis circuit. The reer or transmitter designer can then k out the values of the components to the particular impedance level withany other information.

he time constant of the pre-emphasis uit is equal to the inductance divided he resistance while for the de-emphacircuit it is equal to the capacitance tiplied by the resistance. The units ch must be substituted in the formure seconds, henries, farads and ohms. Figure 5).

ry, for example, you decide that a 00 ohm series resistance is suitable the receiver de-emphasis network, the required capacitance for a 50 osecond time constant is equal to 50 ded by 10,000 divided by one mil- and multiplied by one million, to g the answer to microfarads.

ork this out for yourself and you note that the answer is .005 mfd.

For 0.1 megohm the shunt capacitance for correct de-emphasis would be .0005 mfd or 500 pf.

Similarly if you are called upon to work out the constants of a pre-emphasis network for a transmitter you can do so by substituting in the formula.

A TRANSMITTER

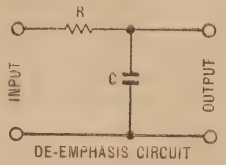
The required shaping of the frequency characteristic in the transmitter could be obtained by taking the output across the required LR time constant series circuit supplied from a high resistance source, e.g. suitable values of L and R in series could be used as the load for a pentode valve.

The connection between a de-emphasis network or a pre-emphasis network and time may not be perfectly clear. Briefly, if a capacitor is charged through a resistance from a battery with a steady voltage, it will eventually charge up to the battery voltage.

It can be proved that the voltage across the capacitor never does actually reach the battery voltage but that it does reach 63 pc of the battery voltage in a time of R times C seconds. The 63 pc is a significant number which has a mathematical basis.

Therefore, the time constant is a convenient way of describing the relative effects of resistance and capacitance or resistance and inductance as the case may be.

One item which is set out in the offi-



De-emphasis circuit as used in the FM sound section of a television receiver.

cial standards along with the details of the transmitter characteristics is worth mentioning now. It appears as follows:

TRANSMITTER CHARACTERISTICS

The radiated signals from both sound and picture transmitters shall be horizontally polarised.

The significance of the "both" is the obvious one that it allows both the sound and picture carriers to be received on the one broad-band aerial.

Not so obvious is the requirement that the radiation be horizontally polarised. In fact in England vertical aerials are used.

One of the most important advantages of the horizontal polarisation as far as the installation of the receiver is concerned is the ease with which the aerial transmission line can be brought away from the active element of the aerial without interfering with the horizontal pattern.

Added to this the horizontally polarised receiving aerial tends to respond less to stray interference fields such as those from motor ignition systems and electrical machinery.

In a following article we intend to discuss the details of the picture signal modulation, the reasons for the particular standards being adopted and their significance in the design of a receiver for Australian conditions.

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OFF THE RECORD — NEWS & REVIEWS

At a recent meeting of the Australian IRE in Sydney, a lecture demonstration of the new EMI system of Stereosonic sound was given in the EMI studios before an audience limited for reasons of accommodation to about 100 persons.

by John Moyle

ESSENTIALLY the equipment was the same as that used for a demonstration in the Festival Hall, London, which I heard early in May of this year.

The main difference was in the playback equipment, for the size of the Festival Hall demanded amplifiers and speakers of very great capacity.

The equipment used in Sydney is that which EMI is making available to the public for use with their Stereosonic tapes.

The evening was in the hands of Mr. R. V. Southey, Director and Recording engineer of EMI in Australia, who read a lecture formerly given in London before the Institute of Electrical Engineers by Mr. H. A. M. Clark, a pioneer in the field.

It is not possible to give a detailed summary of the paper. However, a general idea of the system can be given here without departing from my custom of avoiding technical treatment.

THE EMI METHOD

The EMI method is based on work carried out many years ago by A. D. Blumlein, who spent a great deal of time analysing the way in which our ears can receive a sense of position, using only two loudspeaker sources, which EMI considers the maximum number economically useful in the home.

As I have already pointed out in the reports of my recent travels, there are three main lines of attack on the problem of stereosonic sound, to borrow EMI's phrase for the time being.

One of these I heard at Philips, in Eindhoven, and I was most impressed with it.

Broadly speaking, it consists of placing suitable microphones in an artificial head in the same relative positions as occupied by our ears, and attempting to duplicate by this means the various sound pressures and phase differences between channels which occur in actual listening.

The results as I heard them in the playback studio at Eindhoven were very fine, and much superior to anything I had heard in Australia before I left.

The second is a method frequently used, particularly in the USA. Two or more microphones are used, and the incoming sound is mixed and separated into two channels in such a manner as to give the best overall effect when monitored under suitable listening conditions. This method is not limited to two playback channels. I note that, in a recent American periodical, details are now given of a three-channel set-up by Mercury, about which I learned while in America, but unfortunately did not hear. Several recording companies, and possibly Mercury also, have done work with even more channels than this.

BASIC THEORY

The third is the EMI method which differs materially from all the others.

It is based upon the theory that there are two ways in which the location of sound is detected when listening to the two channels. The first is by differences in the amplitude of the sounds which arrive at our ears, and the second is by differences in their phase or time lag with respect to each other.

The microphone which feeds into the recording networks has two pressure type units, mounted one above the other, and at right angles.

As with all other such systems, it is assumed that the listener will take up a position as near as possible to the centre line between the two loudspeakers and in a space within a given angle.

The EMI system, by a special arrangement of circuitry, resolves all the recorded sounds on this basis, and it is claimed that this feature is mainly responsible for closing up the gap which might appear between the two speakers with other systems.

SAME SOUND PRESSURES

Thus it is intended to reproduce at the ears of the listener the same vector sound pressures he would have experienced by direct listening in a position corresponding to the microphone in front of the sound stage.

At frequencies above 700 cycles, it is the difference in the amplitude which is most noticeable. In the high frequency region, the length of the sound waves is so short that the phase differences between them tend to become random, due to the effects of reverberation associated with the recording and playback, and because the distance between the microphones (and our ears) is greater than the wavelength of the sounds.

At frequencies below 700 cycles, however, the difference in phase between the two channels is the predominating factor.

Listening to sound produced in this manner, said Mr. Southey, gives a realism not possible with any other system.

For a given amount of ambient or reverberant sound, definition, or the ability to distinguish between instruments, is greatly improved.

Bass reproduction is much better, and there is no need to build up the undulating long low frequency reverberation as is so often present practice.

HIGHER LEVEL

It is possible, too, to use a higher level than with a single channel before the listener experiences discomfort, and thus the permissible dynamic range is greater than the stereosonic system. The sound appears louder for a given amount of power in use, although the reason for this is not yet clear.

All these benefits are apart from the illusion of space and movement which goes with it.

The equipment demonstrated used twin-track tape machine of high quality. There were two speaker units, each with an elliptical bass speaker and an electrostatic middle and high-frequency unit mounted in identical cabinets.

My reactions to the demonstration which, oddly enough, used tapes made in the USA, were shared by the audience, or that part of it fortunate enough to be seated in the correct section of the hall. I thought that the sound was first class, and that the advantages named above were all present in varying degrees. Indeed, I thought the demonstration, by its more intimate nature, was much more impressive than that given in London, where the location of the piano, of a singer, and of single instruments was made very difficult, mainly because of the wide spacing of the enormous loudspeakers and the dimensions of the hall.

VARIABLE EARS

But to my ears, at any rate, there still seemed to be an impression of a hole in the centre on some items, although even in this regard the demonstration was better than many others I have heard. It is possible that the characteristics of individual sets of ears may have something to do with this, as the reactions of the audience, tested in conversation over a cup of coffee before we departed, were many and various on this point.

I doubt whether many would deny that the use of three channels, recorded on wider tape, as Mercury did it, would perhaps place this doubt beyond question

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just as it would complicate the issue at the equipment end and add materially to its cost.

But could not this third channel be obtained very easily from a mixture of sound taken e.. ly from both those now present? It would, of course, imply an extra amplifier and loudspeaker, unless it were possible to carry out the mixing in the loudspeaker circuit, thus eliminating the additional amplifier.

After all, there seems little doubt that the whole presentation of stereosonic sound pre-supposes an operator who is prepared to spend some time and money on getting results, and it is not likely to worry the vast majority of people who will still continue to use disc records and a single listening channel.

NEW REQUIREMENTS

It is interesting, too, to speculate on the requirements at the recording end for the production of convincing tapes.

It seems probable that a new conception of microphone placement, recording chambers, and orchestral instrument arrangement will be needed.

At the present time, there is a measure of flexibility possible in the use of numerous microphones, calculated to supply the mixing panel with a variety of effects and balances for best results through a single channel.

Those would probably be out of place with the EMI system, for the whole success of the idea would seem to depend on the carefully calculated blend of sound from the two units in the stereosonic mike.

Echo chambers, used so freely for small groups and popular recordings, would seem to have no obvious place, for they might easily destroy the very illusion the system is designed to produce.

IMPORTANT POSSIBILITIES

If, however, the two channels were to be built up at the mixing panel, as suggested at the beginning of this discourse, it might be possible to achieve most of the benefits of the EMI method with important acoustic additions not possible when confined to a single microphone position.

Whether EMI's claim to have eliminated the "hole in the middle" would overshadow such a procedure, only time and experience will tell. There is much water yet to flow under the bridge before this new concept of sound settles down to anything like a definite technique.

One thing I think is clearly evident, for those who can afford it, and accommodate it satisfactorily in their home, the multi-channel sound will bring an entirely new standard of realistic listening.

IG IMPROVEMENTS

This does not contradict my earlier ick of enthusiasm for the Cook method I heard it a couple of years ago, r which I was rather bitterly criticised one or two readers.

I made it very clear then that my impressions might be different after hearing better example than was possible at at time.

The advances and improvements made ce then, and I think they are most aterial, have brought to light those bet- examples, and can give vastly better monstrations of what stereosonic sound ly accomplish.

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It is almost impossible to fully appreciate the stature of Wagner's operas merely by hearing occasional extracts. More than any other composer, he gains from LP's ability to present complete works in a physically manageable form.

WAGNER: Die Walkure, with Martha Moedl (Brunnhilde), Ludwig Suthaus (Siegmund), and Ferdinand Franz (Wotan). The Vienna Philharmonic Orchestra, conducted by Wilhelm Furtwangler. English-German libretto and list of leitmotifs are included as a booklet. HMV. ALP1257-1261.

When I was in London a few weeks ago I was lucky enough to see a full performance of The Ring at Covent Garden.

I stress my good fortune because all the critics agreed that musically it was one of the best performances London has so far heard. Some of these judges are quite long in the tooth as Wagnerites, and, as they included men such as Ernest Newman, I am quite prepared to agree with them.

The cast was an imposing one. Hans Hotter was an incomparable Wotan, Wolfgang Windgassen sang Siegfried, Otaker Krauss, Alberich; Peter Klein, Mime; and Margaret Harshaw, Brunnhilde. The orchestra, under Kempe—a conductor of whom I believe we will hear a great deal more—was superb.

My interest in this recorded version of Die Walkure, therefore, is particularly keen, although I find it very hard to listen objectively without being aware of the enormous disadvantage of hearing sound alone.

STAGING IMPORTANT

For The Ring, more than any other Wagnerian opera, demands staging, and fine staging at that, if more than a shadow of its reality is to be perceived.

Even at Covent Garden, where the scenery was in the modern economical manner, I felt that the opera lost in stature in the same ratio as it lacked in magnificence.

Once the eye begins to explore the stage, to note with what ingenuity duplicate use has been made of portable geography, the spell is lost.

And you'll get nowhere with The Ring unless you are prepared to go along with all the improbabilities of the story and action. It's about Gods and Heroes, and there is no profit in it unless all concerned are able to build some conviction into its theatrical bones.

Once you have come to the necessary mental compromise, however, you are lost. Time will stand still, for there is nothing in all music which holds such power and dramatic force.

BOOK OF WORDS

I think it is rather important to appreciate some of these things, because otherwise one could be quite disappointed with even the best recording of the Ring.

But if you are prepared to spend enough time to really know the work—and there is a fine booklet of English-German words to help—you will find it most rewarding. Many music-lovers tend to sidestep Wagner because he does require some mental effort, but no one who has a real feeling for music can afford to do this for long.

My reaction to this recording is that it is probably as good as we can expect. With such a wide scope of action and with such demands on every member of the cast, it is inevitable that we will find good singers who can't act and vice versa, or that here and there something has gone wrong.

Of the singers, I thought Wotan was extremely good. The demands upon him are vast.

He is heard as the master of Walhalla in all dignity, he thunders against Brunnhilde in an avalanche of outraged wrath, he bends under the tongue-lashing of Fricka in helpless frustration, and in his farewell to Brunnhilde, sadness and foreboding of the Fate to come create one of the Ring's most moving scenes.

In the flesh, Hotter was superb in this opera. But Franz is entirely adequate, and what is more he projects his mood with exceptional consistency and conviction.

About Martha Moedl, I cannot be as enthusiastic—it sounds as though the part is beyond her. No sign of stress can be allowed to weaken Brunnhilde's wild spirit and vitality. Here is the tragedy of a strong will broken by the same Fate as overcomes all those woven into the story, and as a first essential she must handle her part with ease.

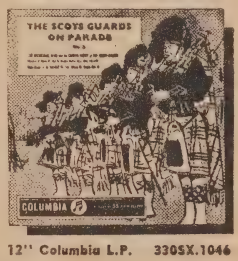
FINE HUNDIG

Siegmund, too, I thought lacking somewhat in a strong vocal edge. His opponent Hundig, on the other hand, possesses a full stature, and Siegmund's counter is a little too soft.

The Valkyries, always a source of difficulty, should have been better balanced.

(Continued on Page 105)

THE SCOTS GUARDS ON PARADE No. 2



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Otherwise my comments can only be highly complimentary. Furtwangler is unequalled in his handling of the score and it would be impossible to list all the moments made luminous with his mastery. He would have been helped by a wider dynamic range in the recording. Some of his blistering climaxes lost a good deal of their initial force, a loss which today's engineering might have avoided. I would also have liked more reverberation in the big orchestral passages, for at all costs these must never be allowed to sound light in size or weight.

MUSIC OF JOHANN AND JOSEPH STRAUSS VOLUME I: Played by the Vienna Philharmonic Orchestra conducted by Clemens Krauss. Decca LXTA2965.

There are some differences of opinion as to what constitutes the genuine "Vienna" atmosphere, probably because comparatively few people have had experience of the real thing.

But how closer could we expect to get to it when we have such a fine Viennese orchestra playing under a conductor who was born in the famous city of dreams?

I'm sure that will be your reaction, as it was mine, when the first bars of the Blue Danube issue from your loudspeaker.

It is played with just the right combination of dignity, gaiety, lilt and rhythm that make the waltz what it is, and without which it is nothing.

I doubt whether I've ever heard the "Danube" done so well, and most of the others are just as good.

The recording is smooth and balanced —no attempt has been made to be spectacular, for which we can be thankful. There is some variation in quality between the five numbers, however, which points to the mixture of different recording sessions. You'll certainly notice this if you play them all at one sitting—but altogether a recommended procedure in my opinion.

But it's a nice record—well above the average of its type. Use the RIA curve.

BEETHOVEN—Symphony No. 5 in C Minor Opus 67. Played by the Philharmonia Orchestra conducted by Herbert von Karajan. "Abscheulicher!" from Fidelio sung by Elisabeth Schwartzkopf. Columbia 330CX1266.

Essentially this record has most of the things required to make this giant sound the way it should.

It has drive, majesty and a sense of power for which many strive, but which only a few manage to achieve.

The first movement starts off with a vigorous tempo, rather too much so, I thought. Many significant pieces of phrasing and orchestration have been overwhelmed in the rush. As a result, the orchestral tone isn't always as clear as I would wish; the sounds combine with something very like acoustical confusion.

But better, much better, this way than the other way round, where undistinguished plodding is the trap.

In the second movement, the tempo is just right. Karajan gives the impression of a giant in a quieter mood, but he makes it quite clear that it is only a mood—there is yet more tumult to come.

The only rival in my view is Kleiber's effort on Decca, but Karajan manages the transition from the third to the fourth movement best of all. He handles that outburst in a blaze of sound, with no hint of a check either on his part or on that of the recording engineers, who so often spoil the impact of the first chord for fear of overcutting the disc. Kleiber's fortissimo isn't nearly as clean cut or effective.

As for the sound itself, Decca's bass is better, and balances more evenly than Karajan's. It is strange that in no version I have heard is that flourish of the flute in the final section of the symphony really good. It should be a real flourish, with a firm whip to it, but somehow it always seems to sound hurried and even ridiculous.

For all that, this is a satisfying disc, if not yet the masterpiece which I'm sure one day we shall receive.

SIBELIUS—Symphony No. 5 in E flat major; Night Ride and Sunrise, Symphonic poem Opus 55. Played by the London Symphony Orchestra, conducted by Anthony Collins.

This is the same broadly moulded, urgent type of Sibelius you have been used to in previous performances by Collins. If anything, he dismisses some passages rather too summarily, but he is never lacking in shape or intent.

Here, too, is the tendency toward the theatrical, for Collins is a showman, if a competent one. But without doubt he understands Sibelius and you will admire his work here if you like his style.

For the record, Collins is a big man, who hops up the steps of the concert platform purposefully and with great agility. His Beecham-like beard and bald head give him an air of fierceness in keeping with his attack on the music, which he guides with imagination and authority.

Come to think of it, that's quite a good further comment on this symphony.

Technically, the record is good, although I doubt whether it is from a recent Decca batch. It sounds very much as though made at the same time as the others. The surface isn't completely clean, although not deserving of any great censure.

Altogether a fit companion for the rest of the set. If the Decca compensation is too shrill, try RIAA.

RAVEL—Pavane Pour Une Infante Defunte. FALLA—El Sombrero de Tres Picos, Suite. DEBUSSY—Prelude A L'Apres-Midi d'un Faun. DUKAS—l'Apprenti Sorcier. Played by the Philharmonia Orchestra, conducted by Guido Cantelli. HMV OALP1207.

Here is a disc-and-a-half — a blend of first-rate recording with some really shattering performances.

Literally shattering is the L'Apprenti Sorcier, unsurpassed to date for skilful and dramatic development of the story, for the conviction with which the ever-rising torrent engulfs the scene and drives the witless one to distraction, and for the precision and vitality of the playing with which it is all done.

This is an absolutely first-class example of the work both of Cantelli and the superb Philharmonia.

Equally good in its achievement is the ravishingly beautiful L'Apres Midi. Here the mood is in complete contrast, and it is here, too, that some of the best playing takes place. The orchestral descent into complete abandonment under the lazy afternoon is exquisite, marred in only a minor fashion by a rather too abrupt ending, if such a word can be version than this one.

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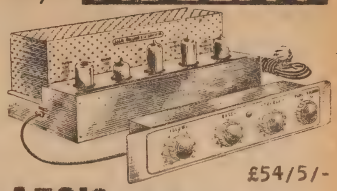

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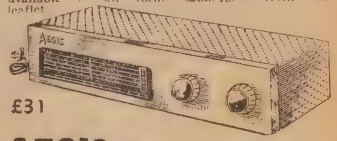

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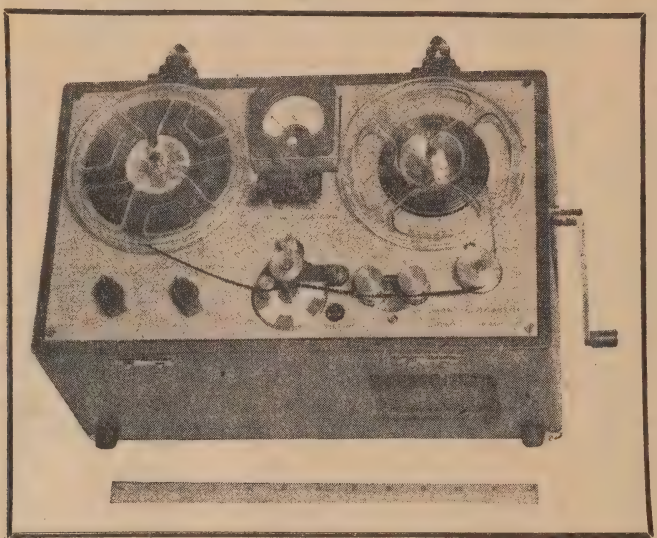

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On the reverse, I liked Falla's Suite best, but almost anything would constitute an anti-clamix after the Dukas and Debussy.

My only grouch is that the surface exhibits some minor hiss on both sides. But for that, the five stars would be hovering very close. RIAA curve is best.

RAVEL—Bolero. HONEGGER—Pacific 231. DUKAS — The Sorcerer's Apprentice. RAVEL—La Valse. Played by L'Orchestre de la Societe des Concerts du Conservatoire de Paris, conducted by Ernest Ansermet. Decca LXTA5004.

Had this record contained some of the sheer excitement which was the outstanding characteristic of the Cantelli disc, it would have been a world beater. Its recording is even better than that of HMV. It has an inner clarity of sound which Decca manages so well, and which lately we are hearing in a much improved version.

But Ansermet seems to pay so much attention to part-perfection that his mathematical mind cannot throw calculation to the wind, even once, for fear that something won't quite add up in the wash.

L'Apprenti Sorcier as given here makes a fascinating contrast with that of Cantelli. Ansermet's delineation of the score is incredibly worked out. Notice that descending flute passage near the end when the cataclysm is at its height, and the Apprentice is quite frantic with terror and desperation. How effective it is, and yet how rarely do we even know it is there!

For Cantelli, it represents just further color to mix with the others on his brilliantly-blended canvas, whose brave picture overshadows that of Ansermet, although it does not equal it in clarity of line.

The story is much the same in Bolero. I always find this interminable, although technically here is a fine performance.

Pacific 231 isn't at all a shocking thing today—its imitative technique, and even its methods are no surprise to the present generation.

Of the four selections I liked the Ravel Waltz. I thought it succeeded best in what it set out to do.

Finally, I come back again to that fine Decca sound, its full frequency and dynamic range, its clear annunciation, its firm bass, its hard and convincing tympani. It's good to hear discs like this.

You should use the RIAA curve.

BEETHOVEN.—Concerto for Piano and Orchestra No. 5 in E flat major (Emperor). Played by Wilhelm Kempf and the Berlin Philharmonic Orchestra, conducted by Paul van Kempen. Deutsche Grammaphon 8131LPM.

A very fine Emperor. It may not be the most dramatic, but it might well be the most musical, if we exclude the early records of Schnabel from the argument.

It is a concert hall type of performance, with the mikes so placed as to allow more-than-average reverberation, but not enough to spoil general orchestral clarity. Nor is the piano unduly to the fore—in fact there are times when it blends so deeply into the orchestra as to be almost lost.

If you listen carefully you will hear some variation in the piano-to-orchestra balance, but it is cleverly done, and the piano always seems to be in good proportion.

Kempf plays Beethoven well, sometimes unsteadily, perhaps, and short of the complete discipline which the music requires. I thought his judgment of dynamics not always reliable—frequently in the first movement minor climaxes were almost thrown away for no apparent reason.

His second movement is lyrical and light—it misses in thoughtful quality, as though predominantly a quiet interlude before the last.

In the last movement Kempf is again lyrical rather than firm, and treats the music as a series of interludes rather than a single shape.

These points I make more as comment than as criticism, for there is little doubt about his musicianship, vitality and authority.

The orchestra is extremely good, although allowed only a modest dynamic range. Some tubbiness in the bass, noticed at times on the piano as well, may be due to some boost after recording.

The surface, for which Deutsche records are famous, is very clean, with only occasional lapses from complete perfection. The RIAA curve is OK.

BEETHOVEN—Violin Concerto in D major, played by Mischa Elman and the London Philharmonic Orchestra, conducted by Georg Solti. Decca LXTA5068.

I cannot report anything much in favor of this record, which is so far below the standard of several others as to merit very little attention.

I know that Elman has admirers, and that the "Elman tone" is a legend. But in my view he has always shown many severe limitations, and his playing here does nothing to remove them.

Without doubt he frequently extracts very broad and beautiful sounds, particularly when he has the opportunity to "lay it on", as for instance in the slow movement.

But on the debit side there is so much scratching and sheer failure to cope with his task as to more than overbalance the good. At times, let's face it, things sound very much like a pathetic struggle against the inevitable.

My respects to a veteran of the bow, but I just can't recommend what he has to offer.

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Duties: Prepare and implement syllabus for native trainees in telephone equipment; refresher courses for Europeans.

Technical Instructor (Radio Equipment)

£1308-£1458 p.a.

Qualifications: Equivalent P.M.G. Senior Technician (Radio); good teaching ability.

Duties: Prepare and implement syllabus for native trainees in radio equipment; refresher courses for Europeans.

Location: Port Moresby.

Senior Technician (Telecommunications)

£1128-£1188 p.a.

Qualifications: Equivalent P.M.G. Senior Technician (Telecommunications); automatic and manual telephone experience.

Duties: Install and maintain equipment at main exchange.

Technician (Telecommunications)

(5 positions)

£968-£1068 p.a.

Qualifications: Equivalent P.M.G. Technician (Telecommunications); automatic and manual telephone experience.

Duties: Install and maintain equipment.

GENERAL INFORMATION

SALARY: *Rates quoted are actual and include cost of living and Territorial Allowance. Married Officers receive an additional £173 per annum. Advancement is by annual increments within the ranges.*

ELIGIBILITY: *Adult British subjects under 45 years (males).*

APPOINTMENT: *Permanent subject to satisfactory probationary period.*

LOCATION: *Appointees are required to serve anywhere in the Territory. Where location is stated, it refers to headquarters or initial posting only.*

ACCOMMODATION: *Except where specified, single quarters only available. Married accommodation unlikely to be available under eighteen months from date of appointment.*

SEPARATION ALLOWANCE: *Payable at discretion of Territory Administration; designed to compensate for added expense of married appointees obliged to maintain family outside Territory.*

LEAVE: *Three months after each twenty-one months in Territory. Additional three months' leave after each six years' service and six months' furlough after twenty years' service.*

TAXATION: *Income derived by residents of Territory from sources within Territory is not at present taxable under Commonwealth legislation.*

FURTHER INFORMATION: *Information Handbooks on the Public Service of the Territory are available from any Official Country Post Office, District Employment Office, Commonwealth Public Service Inspector or from the Department of Territories, Canberra or Sydney. Other enquiries to Department of Territories, Canberra (Phone U 0411, Ex. 28A).*

APPLICATIONS: SUBMIT *on prescribed form available from Offices mentioned under "Further Information."*
TO *Secretary, Department of Territories, Canberra, A.C.T., by 13th November, 1956.*

Senior Technician (Radio)

(5 positions)

£1128-£1188 p.a.

Qualifications: Pass in P.M.G. Senior Technician (Radio) examination or equivalent.

Duties: In charge zone transmitting and receiving stations (transmitters 500 W power) MF and HF, CW and radio—telephone, trunk and out-station services.

Technician (Radio)

(5 positions)

£968-£1068 p.a.

Qualifications: Equivalent P.M.G. Technician (Radio) HF and V.H.F. experience desirable.

Duties: Assist in maintenance and operation zone and out-station radio equipment.

Supervising Technician (Radio), Grade IV

£1488-£1518 p.a.

Qualifications: P.M.G. Senior Technician (Radio) or equivalent.

Duties: Inspect and test radio plant and equipment; assist in planning radio trunk requirements.

Supervising Technician (Radio), Grade III

£1398-£1458 p.a.

Qualifications: P.M.G. Senior Technician (Radio) or equivalent.

Duties: Install and maintain regional radio communication equipment, inspect stations.

CHOPIN—24 Preludes played by Moura Lympany. HMV OCLP1051.

A most enjoyable record. This lady, to nom I owe an apology — her name me out as Moira in a recent issue— ves the music a sympathetic and alto- ther feminine touch which I am sure u will find delightful.

The piano tone is quite good, although ore remote than for Gulda on Decca, a lease of some months ago.

On the whole, I think I prefer Gulda, t there are probably more acceptable ys of playing Chopin than any other mposer, and with performances of this ndard it is largely a matter of personal eference.

The surface is quite good, and I heard out with the greatest pleasure.

CHOPIN—Nocturnes 1-10. Played by Artur Rubenstein. HMV OALP1157.

There's no drooling or sighing about s kind of Chopin. Rubenstein plays in strictly classical style which, in a lesser an, might have ironed out the essential ical quality which the Nocturnes deand.

Once or twice they almost do this, but, an overall view, one cannot deny that s is fine Chopin. The right hand ides the melody with complete assurce, giving an impression of strength d controlled power which the purist ll love, but the sentimentalist may not. There is, to my mind, a certain patchiss about the pianist's success, but then Nocturnes are more than a little that y.

Rubenstein has never done better Cho- than in the Mazurkas, which go back the "78" era.

For with Nocturnes and Preludes, there the shadow of Lipatti, who combined many of the right things about Chopin h humanity greater than Rubenstein's. The recording in the main is good, alough on a few loud passages there is me deterioration. On wide range uipment, the surface will show as a nt rustle. The RIAA or EMI curves to be preferred.

RESPIGHI—The Fountains of Rome, The Pines of Rome. Played by the NBC Symphony Orchestra, conducted by Arturo Toscanini. RCA L6002.

This is the first of the RCA-Victor ords released by AWA that I have rd so far, and I think congratulans are in order in anticipation of good ngs to come if this one is to be taken a sample.

t is a good choice as a debut, for only is the music brilliant and irreible, but it presents the work of Tosini, now retired, as you have rarely rd it.

Forget those horrible things made rs ago in studio 8H, about which one uld almost imagine a conspiracy existto strangle them at birth.

This is a new kind of RCA sound, , rich, and very impressive.

he maestro's hand is here, fully in trol, firm and demanding in fortisio, meticulous as ever in the turn of hrase, steady as a rock in the long. v slopes of sound, where tumult rs to quietude, and dying chords r off into silence.

is possible that some sensitivity has e from his touch, as we might expect, wing more emphasis on the rigidity is beat and his insistence on utter ision. But these are comparatively

(Continued on Page 111)

OISTRAKH'S STAR SHINES ON DGG

On my return from months of wandering, I was particularly pleased to find DGG records more widely obtainable here through the Australian issuing authority which now is Philips.

DGG records have gained a front-rank reputation the world over for their technical and musical excellence, and this reputation doesn't seem to have suffered through Australian pressings.

Judged purely as recordings they are not shockers—they do not assail the sonic possibilities. They are essentially musical, they strive to achieve a quality midway between the highest hi-fi and a more modest, grateful sound which wears particularly well.

In this they follow the English and European pattern of which they are first-class examples.

TCHAIKOWSKY—Concerto for Violin and Orchestra in D major, Opus 35. Played by David Oistrakh and the Satchsische Staatskapelle Dresden, conducted by Franz Konwitschny. DGG 18196LPM.

This I think is the best Oistrakh record to date. The concerto itself has surprisingly little to rely upon for its place among the most popular of its kind. Like the piano concerto, it demands the highest technical mastery, and as Horowitz dealt with the one, Oistrakh has with the other.

He dives into it with the gusto and confidence of a champion swimmer tackling a wild surf, tossing off the digital dangers at the first assault with vicious ease, reaching the calm waters, where for a spell he luxuriates in powerful and luscious tone, finally to re-enter the wild race with the greatest vitality and mastery in the headlong pace of the final movement.

With such treatment, the concerto comes to life as we rarely hear it. It carries with it an irresistible exhilaration which will draw a grunt of approval from the severest musical pedant.

This is truly a violinist's concerto in which the soloist is busy nearly all the time. The orchestra mostly provides an accompaniment to a display of virtuosity, and not a very imaginative one at that, so that the extremely forward violin is not out of place.

As with many DGG records, the orchestral recording sounds a bit woolly at times, but it does its part extremely well, and is never caught wanting.

But it is Oistrakh himself who walks off with the honors in an almost unequalled display.

BRAHMS—Concerto for Violin and Orchestra in D major, Opus 77. Played by David Oistrakh and the Sachsische Staatskapelle Dresden, conducted by Franz Konwitschny. DGG18199LPM.

I have always nominated this as the most beautiful of the violin concertos, if not the greatest. Oistrakh has concentrated on this element of beauty with a sensitivity I thought he lacked in his earlier work.

This is most noticeable in the first movement, although, despite his best efforts, he still lacks that warm-hearted sincerity which lesser executants have achieved.

It is there in the Martzy record, although this talented lady cannot match Oistrakh, judged purely as a performer.

Maybe this is something which the polished perfection of the complete master finds most difficult, for the same comment can with truth be applied to Heifetz, the only man who can be classed with Oistrakh in this respect.

Maybe it is a minor criticism in the face of so much beautiful playing.

The second movement responds well to the soloist's sensitivity and sureness of line and intonation. Strangely enough, his tone becomes a little thin and edgy in his attempts to fine it down for the occasion. It sounds best with the full bow playing on the lower strings, where the word "matchless" jumps to my mind as fully appropriate. His acoustic and dynamic balance with the orchestra is particularly good in this movement.

In the last, his touch is a very light one. I would have preferred more vigor and less gentle handling. The depth of cut, too, seems less than in the other two.

Once again, the violin stands out from the orchestra somewhat prominently. More than this—it gives evidence of its special miking; it sounds rather disembodied and acoustically remote from its background.

The orchestra's tone is round and full, with a good bass to balance the forwardness of the violin.

Altogether, I would rate this as the best all-round Brahms yet issued, and one which will wear well.

I used the EMI setting, which helps to tame the sharp sound of the violin.

JACKIE GLEASON

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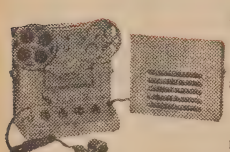

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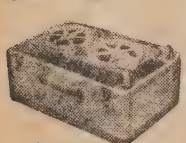

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Peter Clark's New Release Column

GRUNDIGS

The famous Grundig firm has two important new releases this month. First is the Grundig "Stenorette"—newest, lightest, most inexpensive office recorder yet produced. The Grundig "Stenorette" is push-button operated, weighs only 12½ lbs. It enables busy executives to do their dictation at home, then have their letters typed at the office next morning. Price is only 78 gns. Accessories available.

GRUNDIG 820

This month I expect a very limited shipment of Grundig 820. These super high-fidelity machines are capable of 15—15,000 c.p.s. They have three loudspeakers. Call in and see it (it's one of Grundie's best ever). **£225.**

NEW BYER 66

This fully-professional machine is built especially with a mind to the high-fidelity enthusiast, radio stations, film studios. It may be had with inbuilt radio and a host of accessories.

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Many used machines from amazingly low prices are now available. Prices range from **£65, £75, £85, £95,** etc., deposits from **£10, £12, £15, £17,** etc. All used machines carry my personal Guarantee. Why not trade-in your present machine on a new model?

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inor matters against the background f a memorable performance.

As for the recording, it achieves a atisfying mid-point between the concert all and the fully forward technique fav-red by some of its contemporaries. Its alance is good—a touch on the tri-ngle is just as telling as the gruff reply f the double basses.

Of the two sides, I liked the Foun-ins best. I doubt whether you have eard finer performance, rich in weight nd dignity, shot through with light and ovement, a lovely thing to hear.

LEONCAVALLO — I Pagliacci, with Maria Meneghini Callas, Giuseppe di Stefano, Tito Gobbi and the Chorus and Orchestra of La Scala, Milan, conducted by Tullio Serafin. Columbia 330CXS1211-1212.

A reliable and safe performance. tefano makes a convincing Canio. He orks hard, but portrays the passionate nd heartbroken character of the famous own with all the stops out.

Callas captures the passionate drama f Nedda even if she misses her full eminin ity. Her remarkable voice is oaded less with those strange sounds she an produce than in her earlier releases, ut she certainly isn't the frail woman e might have expected. Canio is hard ut to it to match the stature of her ersonality.

The chorus I thought the weakest nk. It has a remoteness which degrades he force of its vital part.

But, for all that, it is, I think, the est Pagliacci to date.

POPULAR CONCERT No. 1, including Light Cavalry, Sleeping Beauty Waltz, Sheep May Safely Graze, Hungarian Rhapsody No. 2, Orpheus In The Underworld, Procession Of The Sardar, and Intermezzo from Cavalleria Rusticana. Played by the Philharmonia Orchestra conducted by George Weldon. Columbia 330SX1032.

Well named. A wide selection of the opular classics played in the manner e might expect of those concerned in right, vigorous and gentle moods.

If you like these collections of time-sted warhorses, you are not likely to ear them done better. Highly recom-ended.

BIZET—L'Arlesienne Suites Nos. 1 and 2. Played by the Orchestre National de la Radiodiffusion Francais, conducted by Andre Cluytens. Columbia 330CX1153.

The jacket says this was a Grand rix du Disque winner, but I can't nagine why.

Maybe the judges rated its tuneful and egant performance more highly than a cording which sounded rather anaemic me after so much full-blooded aterial in this month's batch.

So I'll leave it to you for the ver-ct.

HOMAGE TO FRITZ KREISLER—A concert of 14 numbers made famous by Kreisler, played by Alfredo Campoli with Eric Gritten, pianist. Decca LXTA5012.

Most of these suit Campoli's polished id suave manner admirably, and al-ough you probably won't want to play em all at once, I don't think you'll at all disappointed at what you hear. The recording is clean and virtually ultless.

MERCURY RECORDS GAIN TOP AWARD

★ ★ ★ ★ ★

TCHAIKOWSKY—Swan Lake Ballet (complete). Played by the Minneapolis Symphony Orchestra, conducted by Antal Dorati. Mercury Album OL-3-102.

In this set of three records, luxuriously housed in a pale blue presentation album, complete with an equally elaborate booklet profusely illustrated with scenes from the ballet, Mercury have set a standard which will be extremely difficult to equal.

It is a costly set, and one from which we are entitled to expect great things. I can only say that from first to last I was completely captivated by the excellence of the performance and the almost unrivalled quality of the sound.

Musically, it would have been difficult to select a better vehicle for this ambitious project, for there are few rivals to Tchaikowsky in the field of ballet music, and no better examples of his masterly orchestration. Most of us know the most frequently played episodes, but not so many have heard the many delightful sections which go to make the complete set.

Without doubt, it will be the electrifying sound which will impress you first of all. Not since the original "Pictures at an Exhibition" have I experienced that unmistakable spine-tingling which is the result of unbelievable realism on records.

Its description demands and deserves superlatives. The frequency range will test your equipment to the full, from the most fundamental and powerful bass to the topmost treble.

The dynamic range is enormous. It is a recording which demands big treatment, and plenty of watts to accommodate its tremendous power. And yet in the many delicate and sensitive moments it exhibits a realism and gentleness the more impressive because it comes from an almost perfectly silent surface.

When I have got through revelling in its beautiful sound I might be bothered unearthing my jaundiced eye to pick holes in it, if I can. But I'm afraid that will not be for a long time.

I give it the top award with pleasure.

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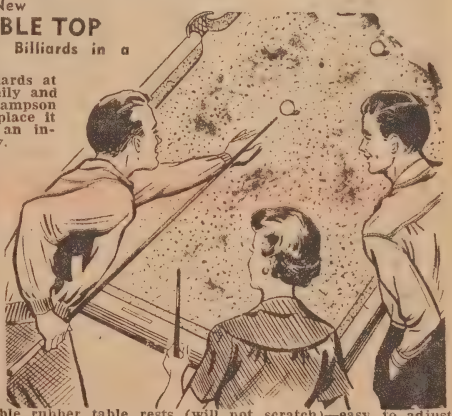

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SHORT-WAVE NOTES BY ART CUSHEN

NEW FREQUENCY IS NOT SO GOOD

Verification just received from the French Somaliland station lists a frequency change which gives adverse reception here.

AN AIRMAIL verification from Radio Djibouti, Post Office, Box 418, Djibouti, French Somaliland, states that the station is operated by Radiofusion de la France d'Outre-Mer. The letter came from the director of radio of Djibouti, Mr. P. Sausseau.

The station uses only 1000 watts, and in reply to our report on the broadcasts of 4975 Kc. they confirmed the reception, also providing the news that on August 14th, a frequency change was made to 4780 Kc. The station operates daily 7.00-8.15 pm and 1.15-5.15 am.

Reception on the new frequency does not appear to be a success, with some interference in the early part of the second transmission by Radio Malaya at Singapore using the same frequency. Congratulations were extended to us for our reception of the station, which appears to have been the first from this area.

11 Metres popular

THE use of the highest frequency band on short wave this summer by several countries, is becoming evident, following the recent tests by Radio Australia.

This band has in the past been regularly used by the BBC, South African Broadcasting Corporation, and Nordwestrundfunk in Germany.

The recent tests by Radio Australia on 25675 Kc. to South East Asia, would enable data to be gathered on such a high frequency in that region, though one doubts if there would be many receivers in operation which cover this high frequency.

The best signals on this band are from the BBC at 8.30 pm, while at the same time signals are numerous on the 13-metre band.

At 9 pm, signals on 13 metres number some 22, audible from stations in London, Singapore, Paris, Oslo, Karachi, Delhi, Munich, Hilversum, Berne, Brussells, Rome, and Moscow. The Delhi transmission at 8 pm is for listeners in Australia and New Zealand, and operates on 21650 Kc. Hilversum broadcast in Dutch at 10 pm on 21480 Kc for the first time for some years.

Taiwan using 9575 KC

THE Broadcasting Corporation of China, broadcasting from Taiwan has been received at good strength on the new frequency of 9575 Kc.

Verification letter from Mr. James Wei, Managing Director of the station, informs us that the new frequency, using the call sign BED5, in chain with BED6 on 11815 Kc, operates in the service to Japan, Korea, Vietnam and South Sea Islands, in the programmes of the Voice of Free China.

The transmission opens at 9.05 pm with the National Anthem and programme content. 9.10-9.20 pm news in Vietnamese; 9.20-9.30 pm news in Korean; 9.30-9.40 pm news in Japanese; 9.40-9.50 pm Press Opinion, a special feature in Japanese; 9.50-10.00 pm program introduction to South Sea listeners; 10.00-10.10 pm news in Kuoyu; 10.10-10.20 pm Press Opinion in Kuoyu; 10.20-10.30 pm broadcast to Chinese overseas; 10.30-10.40 pm news in Amoy; 10.40-10.50 pm news in Cantonese; 10.50-11.00 pm news in Chouchow dialect; 11.00-11.10 pm Chinese music and weather forecast; and 11.10-midnight news at dictation speed in Kuoyu. On Sunday the transmission is the same length but the program content is slightly varied.

The address for reports which are much appreciated by the station is, Broadcasting Corporation of China, New Park, Taipeh, Taiwan.

Singapore to test on 13M

THE present Singapore channel of 21720 suffers some interference at times from the Radio Free Europe transmitter using the same frequency.

The four new 13 metre channels recently registered for use by Singapore are; 21485, 21650, 21655, 21750 Kc. The last frequency is the BBC registration MCY, but it is not used since Paris operate on this channel fairly regularly.

The 21720 Kc station now operates 7.00 pm 2.50 am, this frequency may be placed by one of the four new channels for the broadcast as scheduled

Singapore and San Jose on 9615 KC

A NEW Singapore transmitter with programs from Radio Malaya has appeared on 9615 Kc from 7.30 pm. At 9.00 pm the frequency is used by the San Jose, Costa Rica station TIDCR.

This station carries a news broadcast in Spanish for 15 minutes and at the conclusion gives a list of other stations which are also carrying the broadcast

SIGN-ON TIME FOR BRAZILIANS

The opening times for many of the stations in Brazil which are being heard in this area, are supplied by U.S. listener Roger Legge. This list covers the more reliable signals heard from 49 to 19 metres in the evenings.

KCS	Opening	Callsign	KCS	Opening	Callsign
6000	8.00 pm	PRK5	9675	9.00 pm	R. Munha
6015	6.55 pm	PRA8	9685	9.00 pm	R. Gazeta
6025	7.00 pm	ZYR63	9705	7.00 pm	ZYZ24
6035	7.00 pm	ZYC26	9720	6.50 pm	PRL7
6055	8.00 pm	PRB21	9755	7.00 pm	ZYW23
6095	8.00 pm	ZYB7	9770	7.00 pm	PRL4
6105	7.00 pm	ZYN6	11765	8.00 pm	ZYB8
6125	7.00 pm	R. Nacional S.P.	11775	8.00 pm	ZYZ28
6135	8.00 pm	PRC21	11815	7.00 pm	ZYW24
6147	6.50 pm	PRL9	11825	7.00 pm	ZYK32
6165	7.00 pm	ZYR58	11865	7.00 pm	PRA8
6185	7.00 pm	ZYR77	11925	7.00 pm	ZYR78
6195	8.00 pm	PRD21	11950	8.00 pm	PRL5
9505	8.00 pm	PRB22	11965	8.00 pm	PRB24
9545	9.00 pm	ZYS30	15135	8.00 pm	PRB23
9565	8.00 pm	ZYK3	15145	8.00 pm	ZYK33
9575	8.00 pm	ZYR83	15155	11.00 pm	ZYB9
9610	8.00 pm	ZYC8	15165	9.00 pm	ZYN7
9620	8.00 pm	ZYR83	15190	8.00 pm	PRK9
9645	6.45 pm	ZYV40	15370	8.00 pm	ZYC9

FLASHES FROM EVERYWHERE

INDONESIA'S verifications are now issued by the QSL Manager, P.O. Box 157, Djakarta. Reports sent to Radio Republik Indonesia regional stations are in turn sent to Djakarta for confirmation. A few regionals however communicate direct with the listeners.

BELGRADE broadcasts in English at 4.30 to 4.45 am on 6100 and 7200 Kc.; 8.15-8.30 am on 6100 Kc. The short wave service is operating midnight-3.00 am 6100, 9505; with Home service; relay 3.00-8.30 am a program in foreign languages.

REUNION'S transmissions have been heard by West Australian listener Cyril Anderson on the new frequency of 3380 Kc. This small French island in the Indian Ocean has been operating on 4820 Kc. for some years and has at irregular periods been heard in South Australia by Rex Gillett. The new frequency has been heard to sign off at 3.00 am, and our West Australian listener reports that the medium wave signal on 624 Kc is often of better strength

RADIO KASHMIR is at present operating as follows; Srinigar noon-2.00 pm, 5.30-6.30 pm on 7270 Kc.; 10.30pm-3.30 am on 6110 Kc. Jammu the only other station in the country operates on 990 Kc broadcast band. Reports should be sent to Radio Kashmir, c/o Director of Home Services, All India Radio, Delhi, who will forward the report to Kashmir.

Notes for the next issue should be sent to Arthur T. Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Standard Times.

UGANDA'S transmission from Kampala has extended its evening session and now signs off at 5.03 am. BBC news is relayed at 4.00 am and this is followed by recorded music to close down. This station which uses 7500 watts was heard and verified in March, operating on the present frequency of 5026 Kc.

GOA in Portuguese India has English programs 4.30-11.00 pm, and 1.00-2.30 am using 4890, 7071 and 9610 Kc. The power on the 4890 Kc transmitter is 5000 watts, reports World Radio Handbook.

ARGENTINA has a session in English which is broadcast 9.00-9.25 pm using Radio el Mundo LRX on 9600 Kc and on LRU 15290 Kc. The signal is fair in this area on LRX though mixed with VLQ9 Brisbane using the same frequency. The program consists of news and music, with a session of English news at 9.20 pm, when a woman announcer is used.

RADIO TABRIZ in Iran, which has an attractive verification card, has informed a Radio Australia reporter that they use 7500 watts for the 6091 Kc transmitter. Station operates 1.00-2.00 pm, 7.30-9.30 pm and 11.50 pm-4.00 am

MOZAMBIQUE'S RADIO CLUB station which we have mentioned in recent issues, are now testing with a 100,000 watt transmitter reports Radio Australia, and monitoring of the signals here has shown increased signal strength. The station is testing on 17795 KC. to Europe midnight-1.30 am; on 15085 Kc. 2.00-6.15 am. Reports would be appreciated by the Radio Club of Mozambique Box 594, Lourenco Marques.

MANILA transmitter DZH5 has been heard on the new frequency of 9750 Kc, having changed frequency from 9500 Kc. The signals have been heard in this area and in North America at fair strength. The station relaying the broadcast band transmitter DZP1 and signals have been noted to sign off at 1.00 am. Reception earlier in the evening is somewhat hampered by the use of 9745 Kc by HCJB. Two new Manila stations on broadcast band DZMY (840) and DZXX (890) have not, as yet, been noted on shortwave.

ETHIOPIA broadcasts from Addis Ababa with English Monday to Friday 8.00-9.00 pm and the following morning 2.00-2.30 am on 9620 Kc. and from 4.15 am to 5.30 am over the same frequency and 15010 Kc. Saturday and Sunday 8.00-9.00 pm and the following day the broadcast is released on 9620 Kc. Sundays 4.15-6.00 am the transmission is on the two frequencies; Monday the late transmission is 4.15-5.30 am on the two frequencies reports the ISWC.

THE HAM BANDS WITH BILL MOORE

Amateur radio operators would be able to assist in varied ways during the International Geophysical Year 1957-1958. Plans are currently being prepared for amateurs working during the period and details will be publicised in due course.

THE International Geophysical Year, or IGY, is receiving increasing publicity each week and one is able to read of the wide scientific studies to be carried out to improve man's knowledge of the planet he inhabits.

Several articles have appeared in home and overseas amateur radio journals on the manner in which amateurs will be able to assist in these studies.

Widely dispersed in all portions of the globe, they can provide assistance of a type that could not be made available by any body of hobbyists, or commercial organisations for that matter.

The IGY will be observed from July, 1957, to December, 1958. At this time sunspots will be at a maximum and DX at a peak.

Main amateur activity will undoubtedly centre on observations on the behavior of the ionosphere, when it is hoped to gain knowledge to determine definitely how ionospheric disturbances that affect radio transmission develop in size and move from the poles during a geo-magnetic storm.

They will check, too, whether the existing areas of ionospheric disturbances are on the right track.

Another question to be investigated is how radio absorption develops and moves at the time of these disturbances.

Professor H. C. Webster, Convenor of the Australian National Committee for the IGY, outlined in Amateur Radio how Australian amateurs will be able to assist by observation in the 3-60 Mc/s portion of the spectrum during several displays.

They will be asked to report any long distance communication, especially if the path passes south of 60 degrees latitude.

Satellite tracking will be another means by which amateurs, especially club groups, can assist.

A possibility that a world wide net will be established for the passing of warnings of alerts is also being considered.

The RD Contest

THE 1956 Remembrance Day contest was, as usual, very well supported and several scores over the 1000 mark are reported.

Besides the usual activity on 3.5, 7 and 14 Mc/s, the 21 Mc/s band proved of value and 50 points could easily be recorded for VK2 - VK6 contacts.

Despite quite a deal of activity, analysis, etc., the scoring methods over the last few years, the rules still remain unchanged.

The result is that VK2 or VK3 have no possible hope of ever winning the event.

Since the initial win by VK2 before the current rules were introduced, neither of the larger states had recorded scores within range of the smaller States.

Current RD contest results do not wholly reflect the operating skill of the participants, but a factor of station activity within a State decides the destination of the trophy.

As pointed out previously, 50 pc station activity for VK2 or VK3 would necessitate 500 stations on the air.

It must be appreciated it is far easier to arrange for 50 stations to be active than 500.

The point-scoring table is adjusted to compensate for the varying number of stations in each State. Why the additional adjustment for stations and/or member stations active? Amateurs in the larger States hope that soon some more equitable variation will be incorporated to ensure a more equitable scoring system.

The question sponsored by the RSGB is well worth considering for use in future contests. It is the use of QWU as signalling "I have worked you", a valuable and useful addition to the accepted amateur Q signals.

Often during events such as the RD contests duplicate contacts are commenced and QWU could speed up the cancelling of superfluous QSO's.

Spring Field Day

THE Spring Field Day of the VHF section will be held on October 21, and will consist of a message handling event rather along similar lines to the mid-winter contest.

Stations throughout the State will operate on 144 Mc/s helping to pass messages through-country districts and to interstate amateurs as possible. They will be located at strategic points to ensure that signals will be received in Canberra for instance.

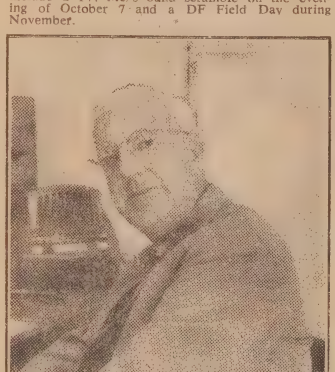
The contest will run from 10 am to 4 pm and is divided into three sections namely, country, fixed and portable

Portable stations must operate at least 25 miles from their home, QTH and country stations are classified as those outside the boundaries of the County of Cumberland and the City of the Blue Mountains.

All stations will be permitted to originate two messages, one in the morning, one during the afternoon. They may operate from any location and some stations will proceed to the ACT and surrounding areas.

Three points will be scored for messages passed to portable stations and vice-versa, two points for handling city to country and country to country and one point for messages passed between city stations.

Future events to be conducted by the section include a 144 Mc/s band scramble on the evening of October 7 and a DF Field Day during November.



Snapped by the Editor during a visit to Hartford, USA, is Dave Houghton, Circulation Manager of ARRL publication and Treasurer of the League. Dave was a close friend of the late Ross Hull, who in the early 30's was technical editor of Wireless Weekly, the predecessor of R. TV. & H.

Amateur TVI

MOST amateurs have reviewed with interest the varied comment in the daily Press on the 21 Mc intermediate frequency incorporated in some television receivers.

The Postmaster-General Mr. Cameron's statements on the subject concerning amateurs' responsibilities have been perfectly clear, and they know their position on the matter.

If the TVI experienced is due to the use of an IF not recommended by the Broadasting Control Board, and located within an amateur band, the amateur concerned will not be required to accept responsibility to clear the interference or to restrict his legitimate transmitting activity in any way.

The Federal Executive of the Wireless Institute of Australia review in the September issue of Amateur Radio fully explained the developments to date, and the PMG's Department rulings provided to their inquiries on the matter.

The subject was again prominently featured in the daily Press.

One report quoted the fact that an individual amateur installed TV sets in his home for TVI checking. It was recorded that when transmitting with the TV antenna only 3ft from the radiating antenna, no TVI was noted.

If such is the case, amateurs generally will be relieved to think that TVI may not present the difficulties anticipated.

The frequency of 21 Mc/s was originally selected for IF use before the 21 Mc amateur band was granted at the Atlantic City ITU Conference. Perhaps technical advances have eliminated possible TVI at the IF; if so, amateurs will be very happy on this score.

Secret Scramble

A SECRET 144 Mc scramble conducted at the conclusion of the VK2WI VHF broadcast on August 26 saw the limited AOCP licensees come to the fore and fill major places in the contest.

Dick Norman, VK2ZCF, first with 19 contacts and Barry Goodman, VK2ZAG, 18 contacts second place.

The 5 September nocturnal hidden transmitter search on 144 Mc was won, as usual, by Bob Winch, VK20A, in approximately 45 minutes. The hidden transmitter was operated by Horry Lapthorne, VK2HL, and located at West Pennant Hills.

The location unintentionally selected was fortunately right beside the QTH of Geoff Menon VK2OG, who warned of rabbit traps in the area, that would have caused concern to both the "fox and hounds".

John Miller, VK2ANF, assisted by Bob Winch, VK2OA, lectured at the September meeting of the NSW VHF section on the subject of "Noise Generators". It was an informative lecture and of tremendous interest and value to VHF enthusiasts. At the conclusion of the lecture various of the local VHF convertors were checked for noise.

Noise figures were quoted causing a little banter on the side, on the comparative virtues of the various converters.

Home for VK2WI

DONATIONS toward the "Home for VK2WI" have now reached the £850 mark and it has been decided to set £1000 as the target for the appeal. Built of brick, the building

TRANSATLANTIC CONTACTS FOR 144Mc

DUE emphasis is being placed on the possibility of transatlantic contacts on the 144 Mc/s band by amateurs in Europe. It is known that high pressure systems often stretch from the Azores to the West Indies and under exceptional circumstances, a favorable temperature inversion could extend from Spain to Florida, a distance of some 3300 miles. The current 144 Mc/s DX record stands at 1400 miles.

It has been noted that island groups between two points appear to act as a barrier and this effect is apparent with the Balearic's in the Mediterranean affecting 144 Mc/s in the area.

The VHF path across the water from FA8IH in Algiers and F9BG in Toulon, France, 500 miles, is one of the best in the world and 70 CM signals have been exchanged between the two stations.

Currently a grid-dip oscillator coupled to an antenna is sufficient to bridge it on 144 Mc/s.

Contests are gradually being arranged for frequencies higher in the UHF spectrum and in September the RSGB conducted one on the 1250 Mc/s band. Run over 12 hours, competitors competed for the Arthur Watts Trophy.

Using ionospheric scatter propagation techniques on the 50 Mc/s band amateurs in the US are gradually gaining experience in this type of transmission. They cannot, with their limited power, duplicate the results of the commercial circuits, but even with powers as low as 75 watts readable signals have been recorded over a distance of 850 miles.

Generally 3 over 3 arrays have been used but a number of stations are erecting arrays with as many as 16 elements.

Ionospheric scatter is mainly evident on the 50 Mc/s band with a limited amount on the 144 Mc/s band and offers communication from distances of 600 to 1300 miles without having to wait for the appearance of sporadic E reflections or other DX phenomena.

Many VHF enthusiasts are concentrating on this type of propagation for their contacts.

Do not forget the VK/ZL DX contest to be conducted on October 6 and 7 for telephony, and October 13 and 14 for CW, running from 1000 hours GMT one day to 1000 hours the next. Serial numbers to be exchanged are as for previous DX contests. These contests are conducted alternately by the WIA and NZART and this year's event is being run by the New Zealand society.

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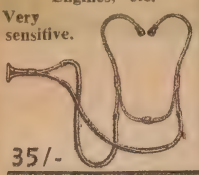

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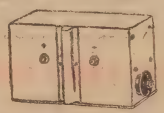

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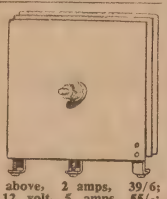
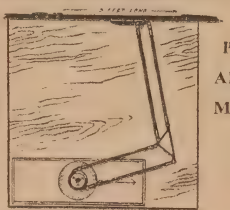


Transformers to suit above, 2 amps, 39/6; 6 volt, 5 amps, 45/-; 12 volt, 5 amps, 55/-; Transformer to suit dual charger, 6 and 12 volt, 39/6. Rectifier to suit, 45/-.



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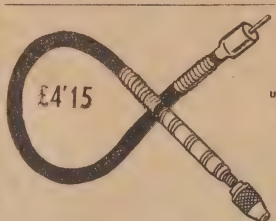

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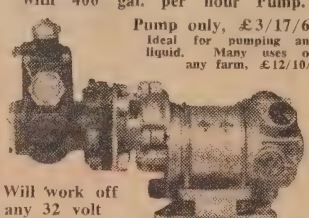

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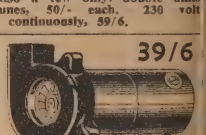

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mprises two rooms, one 25ft x 14ft and the ond 18ft x 16ft. By mid-October, weather rmitting, sufficient of the work should be com-eted to house the official WIA transmitters. l work on the building except the brickwork being performed by volunteer labor. Anyone that could assist during Sunday work-parties at Dural, should contact Jim Corbin, K2YC, for full details, the telephone number, U1092.

Gifts of any surplus equipment that could be ctioned for further funds for VK2WI or ditional cash donations would be appreci-d.

VK2WI, operating with higher power on the and 7 Mc/s bands from this excellent loca-n, will eradicate the problem of QRM and signal strengths recorded in parts of the ntry areas. It should provide a really effec-e news service for NSW and an excellent trol station for emergency working.

News from VK5

ACK de CURE, VK5KO, best known of the Australian 3.5 Mc/s DX men, tallied over 00 contacts outside Oceania from his VK5 H before moving to VK2. He listed 1002 ch contacts, an extremely creditable DX per-rmance. Jack hopes to operate on the band m NSW as soon as he can find a suitable ation.

Together with Dougal, VK5BY, he enjoyed the it of 3.5 Mc/s enthusiast Pat Miller, W2AIS/ 8PM, who visited Australian ports on the oneer Cove.

Pat had a fund of stories concerning 3.5 /s activity from three continents.

ZE3JO has been hearing VK5KO on 3.5 Mc/s und 2030 to 2045 hours GMT at varying engths from RST 569 to 339. Schedules will arranged each Saturday morning and any ateur requiring an African for a 3.5 Mc/s AC should listen out.

Concerning Emergency Networks in VK5, Jim livan VK5JK, writes to say that these are trolled by a Committee comprising John lling, VK5KX, Brian Austin VK5CA with 5JK as Chairman.

Most DX amateurs have been making quick rk of contacts with Danny Weil, VK9TW, erating from new country Nauru. The ARRL nounced that DX credit will be given for ntacts with stations in Nauru from November 1945

OWN SOUTH

Down south, KC4USA and KC4USV have n active mainly between 0200 to 0800 GMT und 14050 Kc/s CW, and very occasionally 14200 Kc/s telephony. Operation to date been confined practically exclusively to ffic handling back to the States for the 93 n located at McMurdo Sound (KC4USV), and 73 at Little America (KC4USA).

The main object of the activity is to keep e men in contact with home, but some time l be spent working DX stations.

The SARL supplied details of QSL cards from 2MI, Marion Island, they will now only be warded on the receipt of an inwards QSL. The 2MI cards will be made by the Government partment which controls the Meteorological tion on Marion Island.

The new cards are very attractive, folding e, printed in red and gold and include a orial map of the island. The South African iety SARL will distribute all cards for 2MI.

The SA Government has also established a eorological station on Gough Island and the sign ZS9AE has been allocated to Barry kensha, ex ZS6AJY, who will operate from re.

DX operators who contacted XE4A at Socorro nd can tally up a new country. The island up, Revilla Gigedo, includes Socorro, San nedicto, Clarion and Roca Partida Islands. W zero gang who journey there added ther page to DX history. ARRL DXCC lit will be given for all contacts with the up after November 15, 1945.

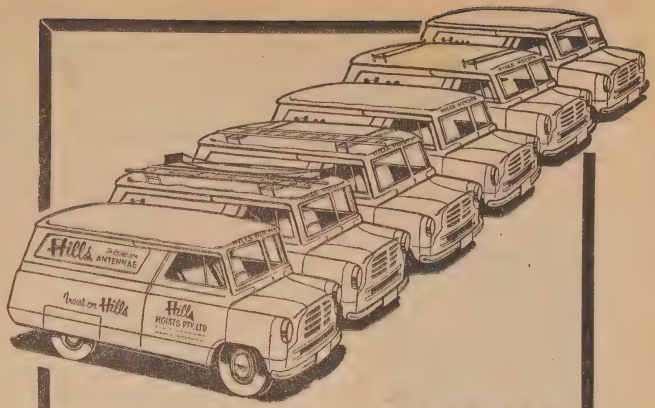
verseas DX

VERSEAS DX comment coming to hand gives the impression that most DX operators e rather amazed with the appearance of ACT gang signing VKI.

Generally they were not pleased as they no longer sort out the elusive VKI stations with DX such a competitive business spend y hours QRX for VKI's with no DX rating.

pparently non-mainland VKI's will receive ew distinctive prefix but in the interim the nge only lent to disorganisation in DX les — the move seemed a little premature.

he 250 country mark for Telephony in the 1 DX Century Club should soon be passed In August Jamie, PY2CK's tally had reached In the CW section, Chas. W1FH, is heading all others with 266 confirmed, e by are W8HGW 265 and W6AM 264. these figures should shortly be increased Nauru and Socorro confirmations still to re.



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7C5	12/6	VT502	12/6
EBC33	12/6	6E5	12/6
1H6	7/6	7A6	7/6
6L6	20/-	AV11	3/9
1C6	12/6	832A ..	£3/0/0
1D4	12/6	6K7	7/6
1G4	12/6	1K5	2/6
1J6	12/6	12SJ7	12/6
1K4	12/6	12SK7	12/6
1K6	12/6	12SL7	12/6
1LH4	12/6	39/44	10/-
1LN5	12/6	46	12/6
1P5	12/6	4	12/6
1R4	12/6	78	12/6
2A6	12/6	809	£2/0/0
3A4	15/-	828	£2/10/0
3B7	10/-	843	£1/10/0
3D6	10/-	957	6/6
6AG5	9/6	1619	£1/0/0
6AM5	15/-	1625	£1/0/0
6AM6	17/6	1629	10/-
6H6	7/6	2050	£1/0/0
6J6	15/-	4307A	10/-
6J7G	9/6	9001	8/6
6N7	10/-	9003	12/6
6SK7	12/6	9004	8/6
6SL7	12/6	RK75	10/-
6SN7	12/6	RK48A ..	£3/0/0
X5	10/-	VR75/30 ..	15/-
6Y6	17/6	VR105/30 ..	15/-
1O	15/-	VR150/30 ..	15/-
12A6	12/6	NR74	7/6
12H6	7/6	ATP35	12/6
KTW62/6U7	7/6	954	7/6
2AB	£1/0/0	1T4	12/6
5U4	12/6	5X4	12/6
1M5	7/6	1C7	7/6
1O5	7/6	1A5	7/6
CV6	3/6	7193	3/6
6F6	12/6	829B	£4/10/0
813	£3/0/0		

NEW

ELGIN 8-DAY AIRCRAFT CLOCKS

Panel Mounting. 2½in. Sweep Second Hand. Cost RAAF £28/10/-. Ideal Car Dash Clock.

£7/10/-

POSTAGE 2/-

NEW

12V. CENEMOTORS

American. 12V. Input. 270 V. 100 M.A. Output.

£4/15/-

PHILLIPS SIGNAL GENERATORS

101C

Thoroughly Tested and Calibrated. Guaranteed Perfect Order.

£29/10/-

OSCILLATOR

144 MEG V.F.O.

Simple to use as Transmitter. Complete with 2 Valves.

7193 x 6A6.

19/6

Postage NSW 2/6. Interstate 4/-.

RELAYS

1700 SPDT 7/6

1300 SPDT 7/6

500 x 500 SPDT 7/6

12 volt DPDT 5 amp £1/-/-

24 volts DPDT 12/6

8-16 volt DPDT 12/6

11 volt AC £1/-/-

Hi-speed Polarised relay .. £2/10/-

400 ohm 12/6

1300 ohm DPDT 15/-

½in Square Section DURAL TUBING UP TO 12ft lengths 1/- per ft

Hi-Lo Phone Transformers .. 4/6

Spirit Level bubbles, mounted 4/6

Canadian Signal Lamps 12/6

Hi-Voltage Lead-Thru Insulators, 1/6 each, 15/- doz

Hydrometers, Battery Testers 5/6

Torches 2-cell Focusing 6/6

Multi-Strand 4 core Cable, Yard, 1/-; 100 yards £2/17/6

Tx. Var. Condensers, 300 pf £1/5/-, 100 pf £1/1/-

60 pf with Vernier .. .. .. £1/1/-, 30 pf 10/-

★★★★★★★★★ RADIO

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

TRAM AT DOOR. STOP 42

COLLAROY ST., COLLAROY — XW5956

T.V. TEST EQUIPMENT

A.W.A.

Lab standard sig. gens.
25 to 50 megs.
240 A.C. power air tested
perfect order.

£37/10/-

POWER TRANSFORMERS

385 x 385. 60 MA.
6.3.25V. or 2.5.85V.

10/-

80MA 12/6

INVERTERS

6V. 12V. 24V. 32V. DC to
60 Watt to operate Radio, Fluorescent
Lights, Shavers, etc.,

£8/17/6

NEW TRANSFORMERS

FERGUSON

VIBRATOR TRANSFORMERS

150 x 150 40MA. 6V £1/4/6
3002 x 300 100 6V £1/17/6
325 x 325 125 12V £3/12/6

INVERTER TRANSFORMERS

6V 240V 40 watt £3/7/6
12V 240V 60 watt £3/7/6
32V 240V 60 watt £3/7/6

C.R.O. TRANSFORMERS

350 x350 extended to 1000V
6.3V 6.3V 215V 4V **£4/5/-**
POSTAGE N.S.W. 5/- INTERSTATE 7/6

DIODE VOLTMETERS

2 ranges to 400V
Tested good order
Meter basic 1 MA

£3/7/6

POSTAGE N.S.W. 5/- INTERSTATE 7/6

New Coils and Intermediates standard or miniature to suit all valves.

Coils B/C 455 KC 9/6
Coils S/W 455 KC 9/6
nters 11/6
oop aerial coils 9/6
lug tuned H.F. coils suit 144 meg. 4/6

NEW

SELENIUM RECTIFIERS

500 V. Halfwave.

300 MA £2/-/-
600 MA £3/-/-
1.2 AMP £5/-/-

250V In
500V Out **£2/-/-** Doubler
300 MA

NEW YAXLEY 3 x 3 SWITCHES 2/9

NEW OAK 3 x 3, 3 BANK 4/9

WANTED

**Communication Receivers
Test equipment, P.A. gear.
Large or small surplus stock,
Best prices. Call, write or
phone any time.**

OIL FILLED CONDENSERS

1UF 600V .. 6/6 .5UF 2.5 .. 6/6
4UF 750V .. 12/6 .5UF 400V .. 6/6
7.5UF 330V AC 10/-

SCA 522 RECEIVERS

Complete front end and IFs less valves. A ready made 144 meg. or vehicle band converter.

£2/17/6

Photostat circuits

10/-

MAGNETIC PAPER DISC RECORDERS

Recordon. Electronic Secretary.
Complete with Mike, Phones, Foot
Switch. Air tested.

£37/10/-

813, 832, 829 SOCKETS 20/- ea. post 1/6

P.M.G. JACKS & PLUGS 4/6 pr. Post 1/-

SENSITIVE RELAYS

5000 ohm. operates on ½ MA .2 MA. Change required Small, light A must for Modellers

£2/10/-

POSTAGE 1/-

MULTIMETERS

AC-DC
5-50-100-250-1000V,
1-5-25-100-500-MA

**2 RANGE OHMS
TESTED ALL RANGES**

£8/17/6

Telephone Equipment

Hand sets £1/9/6
Mike inserts 3/6
Head & breast sets 17/6

Hand sets with pressel switch **£1/15/-**
Hand generators high frequency **10/-**
Adjustable buzzers **7/6**

Miniature telephone units to suit. Hand sets or H & B 10/-

NEW

MONITOR UNITS

240V. 50 A.C. Powered. Addition of H. & V. Amplifier Converts to first class. C.R.O.

£15/-/-

12 VOLT LIGHTING

Plants or Battery Chargers. 1 h.p. petrol engine & 25 amp generator. Direct coupled. Tested. Perfect order. American. Briggs & Stratton or Johnston

£32/10/-

2 GANG CONDENSORS

Stromberg H. with Dial. Used. Good order.

10/-

RIBBED 4-PIN, 1¼ INCH COIL FORMERS 2/6

Postage 6d.

JONES MINIATURE 10 PIN PLUGS & SOCKETS 7/6 PR.

Postage 6d.

NEW AMERICAN INDICATOR UNITS

12 valves 7-6SN7, 1-3AR1, 1-6H6, 1-2X2, 1-6X5, 1-6G6.

£9/17/6

10-line TELEPHONE SWITCHBOARDS

May be used as single magneto ringing phone, or up to 10 lines as required. New. Condition Tested.

£5/10/-

6-lines (as above) £4/5/-

GENEMOTORS

Input	Output			
24V	250V 100MA	£1	0	0
24V	550V 375MA	2	0	0
24V	250V 60MA	1	5	0
12V	500V 350MA	8	10	0
12V	1200V 200MA	6	10	0
6V	500V 150MA	6	10	0

A.C.E. RADIO

Amplification Communication Electronics

PHONE LA3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

AND 636 KING STREET, NEWTOWN

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY — XB5956

DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR, STOP No. 42

6-VALVE RADIOGRAM CHASSIS

Valves and 12 in speaker, Dual wave. 16-50 and 200 500 meters. Separate Bass and Treble Boost and Cut. Input for crystal microphone or tape recorder. 12,000 miles range on S/W. Guaranteed 6 months.

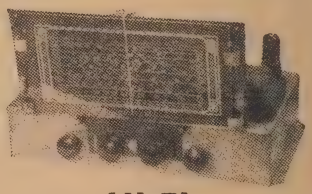
£23/15/0

MULLARD 5-10 SPECIAL

10-VALVE HI-FI RADIOGRAM CHASSIS

Using famous Mullard 5-10 audio circuit latest innoval valves Jensen twin cone speaker, tuned R.F. stage on S.W. and broadband. EM80 tuning indicator. Outstanding quality and sensitivity. Packing for air freight, free for rail 10/-

£42/15/0



HI-FI

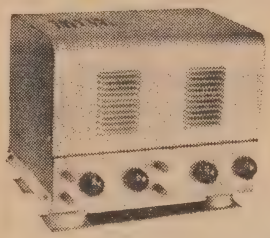
RADIOGRAM CHASSIS INCLUDING BASS & TREBLE BOOST

6 VALVE **£23/15/-**

5-VALVE DUAL WAVE RADIOGRAM CHASSIS SPEAKER AND VALVES. 12in. SPEAKER

£18/15/-

ALSO AVAILABLE AS KITSET £14/15/-



AMPLIFIERS

FROM

£14/17/6

MULLARD 5-10

COMPLETE WITH FERGUSON OUTPUT TRANSFORMER & JENSEN TWIN HI FI SPEAKER 30 CYCLES TO 13 K.C.

£34/15/-

P.A. RANGE

240 V AC OPERATION

6 VALVE 10 WATT £14/17/6
6 VALVE 25 WATT £25/7/6
6 VALVE 40 WATT £32/7/6

BATTERY OPERATION

5 VALVE 10 WATT 6V DC £17/15/0
7 VALVE 12 WATT 12V DC £19/15/0
7 VALVE 25 WATT 12V DC £24/17/6

6V BATTERY & 240 AC OPERATION

6 VALVE 10 WATT £20/15/0

12V BATTERY & 240V AC OPERATION

7 VALVE 12 WATT £21/15/0
7 VALVE 25 WATT £29/7/6

VENTED ENCLOSURES

Standard Size 35in x 23in x 16in for 12in Speakers. ¾in Solid Core White, £13/10/-, Polished £16/-/-

Portable Cabinets, Instruments Cases etc. By Gibbons and Denham. Lowest Prices Patton Products. Stamped Steel Chassis for all R. & H. Projects.

HIGH FIDELITY RANGE

Complete with the amazing New Jensen A.U.53 Twin Cone Speaker. Cross over network Mounting ring and spider Frequency response 50 to 12,000 cycle.

Separate Bass and Treble Boost

6 WATT PP TRIODE OUTPUT £28/17/6
12 WATT PP BEAM POWER OUTPUT £29/17/6
15 WATT PP TRIODE OUTPUT £36/17/6
20 WATT PP BEAM POWER OUTPUT £37/17/6

3-SPEED PLAYERS

Collaro—Garrard—Dual B.S.R.—Goldring

From £11/7/6

3-SPEED CHANGERS

Garrard 110-80-90A, Collaro Dual—Stromberg—B.S.R.

From £15/17/6

THE ELECTRONIC TOTALISATOR

(Continued from Page 7)

iled, the punches would go up and
own in one place on the tape, losing
l record of bets coming through.

On the control board, switches are
ovided to eliminate scratched horses
that their particular combinations
nnot be received nor can a ticket
r those combinations be issued. Signal
mps to indicate which TIMS are op-
ating or faulty are also provided. In
ct, the engineer in charge can see
e complete system at a glance and
itch the various elements in and out
will.

Each TIM carries its own counter
record the total number of sales
om the machine, while the recorder
rries a counter to indicate the total
mber of bets received. These figures
ust tally before the machine is bal-
ced.

Each recorder can handle bets from
TIMS. Between the TIMS and the
corder is the "Distributor", or the
cess Unit, which in this case consists
a series or "chain" of relays.

ME TO SPARE

Experience has shown that there is
apparent delay in obtaining access,
ce the timing is such that, although
is possible for a TIM to have to wait
maximum of one second, the time
ken for the seller to obtain the in-
rmation from the investor and give
ange renders this wait inconsequen-
l. In the majority of instances, since
e transaction takes an average of five
conds, and a bet can be recorded in
s than 1-30sec, the distribution is
ch that the TIM usually obtains access
mediately.

The machine illustrated is for six
MS only so that one relay box con-
ning 12 relays is the complete access
it. Other boxes house the guard and
rm circuits, and a "routiner" which
riodically checks the circuit. The
ole system is run through a recti-
r (with batteries for emergencies) on
volt DC.

ESIGN OF THE READER

Since the basic idea of a photo cell
ader was already established, prob-
ns of design were confined to the par-
ular application.

The greatest difficulty was in relation
size. It was obvious that some
mbination of photo electric cells
uld be necessary. These cells had to
placed in a position to receive signals
m any of the 16 small holes which
re arranged in a line approximately
long.

This was ultimately achieved by
ng perspex light "pipes" which con-
ed of highly polished (solid) perspex
s, approximately 1-8in thick by ¼in
le, suitably masked on the ends to
w only one 1-16in hole at any one
e to illuminate the pipe.

An interesting point with regard to
spacing of the photo cells is that
re are now available photo sensi-
Germanium Diodes, which will, in
probability, be used in later models
replace both the photo cells and the perspex pipes. These diodes, besides being 10 times more sensitive than the well known photo cells, are only about 1-8in diameter by ¼in long.

An interesting fact on the perspex "pipes" is that once the light is directed into the end of the highly polished perspex bar, practically no light is lost in passing through the perspex, no matter how the "pipe" bar is curved or bent, provided that the bends are so made that the light does not strike them at an angle greater than 43 degrees, which is the critical angle of refraction of perspex.

CATHODE FOLLOWERS

The output current from the photo cells is fed to cathode-followers and thence to selector switches. The cathode followers are necessary because of the high impedance in the photo-cell circuitry, which eliminated any possibility of switching the circuit in this area.

After the cathode followers, the selector switches, which are of the rotary type, select the appropriate photo cells corresponding to the code of the winning combinations which, of course, are known at this stage.

From the switches, the circuit is fed to a coincidence mixer or gate with its associated amplifiers so that only those impulses corresponding to the preselected code give an output to the actual counting mechanism. The counting circuit consists of two Philips "EIT" counting tubes, one for units and one for tens, followed by an electro-mechanical counter for the higher numbers.

It will be obvious from the foregoing description of a simple win betting system that to calculate the dividend payable to each successful investor, it is simply a matter of taking the (nett) pool and dividing it by the number of successful investors to arrive at the true dividend figure.

When this dividend is expressed as a fraction of the unit investment, it is known as the "odds". This fraction can be greater or less than one, so that in the extreme case, an investor could receive less than his money back after the percentage deduction was taken from the gross pool.

ODDS CALCULATION

So that the investor can see before investing what his chances are, "progressive odds" are usually shown.

In the early stages of betting, the pool is small compared with the investment, so that the slightest variation in pool figures affects the odds to a large degree. Later on through the betting, the pool stabilises and the rate of change of odds is less erratic. However, it is an important function of the fully automatic totalisators to show the progressive odds on each horse. The odds are (in theory at least) **all** affected by the addition of even one unit investment on any horse.

In the electro mechanical totalisator, one of the most efficient methods of achieving this is to use an analogue computer.

Each horse adder has associated with it a vertical and horizontal bar. Both bars carry small carriages which are moved in accordance with the number of bets on the horse adder (in the case of the horizontal bar) and the grand total adder (on the vertical bar).

The swinging blade which forms the hypotenuse of the triangle then makes an angle which is equivalent to the odds on that particular horse compared with the grand total.

A simple mechanical or electrical device connected to the (top) pivot point of this blade, reads the angle so formed and displays the result to the public in the form of odds of probable dividends.

In actual practice, it is impossible to indicate the exact dividend, due to backlash in gears and scale stepping limitations so that the final actual dividend which is not so "stepped" must be calculated either in longhand or by means of a standard calculating machine.

DOUBLES

Progressive indication of odds for doubles betting has not yet been completely solved, due firstly to the expense and secondly to the limitations in the indication to the public.

Referring to our example where we had 400 different combinations, we would need 400 computers, combined with 400 adders.

Even if this expense were overcome, the problem remaining is how to indicate 400 different odds to the public in a manner to allow them to pick out any particular one at a glance (from varying distances).

This problem has been tackled, though not satisfactorily solved, by using relay or electronic forms of digital computers which scan at preselected periods.

The odds are then displayed with a limited number of figures which gradually scan the whole 400 conditions.

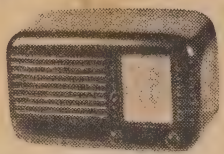
By reading the tape as it leaves the recorder punch and then feeding the results into a computer, the progressive odds can be calculated. However, in view of the large expense involved and the very complexity of the public display for 400 different results, the present punched tape totalisator disregards completely the idea of progressive odds and simply displays the (20) odds for the winning horse in the first leg coupled with all those of the second. This enables the investor to "ride" his second leg horse home knowing exactly what he will receive if it wins.

SLIDE RULE RESULT

To achieve this, it is simply a matter of taking the punched tape after the first leg winner is known and passing it through the reader 10 times, thus obtaining 20 horse totals. These figures are then translated into approximate odds or dividends from a circular slide rule device which has been preset to the known nett pool.

These 20 odds or dividends are then set up by push buttons or any other method which is in use on a particular track, to indicate to the successful first leg investors what they will receive if their second leg horse wins.

MAKING UP THE "LITTLE GENERAL"?



£12/17/6
Post & packing
NSW 14/6,
INTERSTATE 25/-

Complete kit of parts for the 1956 "Little General" as featured in August R & H, including attractive bakelite cabinet with slide dial. Price includes valves and Rola 5F speaker and kit is complete to the last nut and bolt. (Set wired and tested £2/15/- extra). Cabinet size 11½in long, 7in high, 6in deep.
Foundation Kit for above comprising Bakelite Cabinet, Chassis and Dial Assembly 57/6

MICA CONDENSERS

Standard Mica Condensers, small current types .00003 to .005 including most wanted values.

25/- Per 100
Postage 1/6

Electrolytic Condensers

12mfd 525V	4/6
24mfd 350V	3/3
20mfd 200V	2/6
250mfd 12V	2/6
30mfd 350V	3/6
500mfd 12V	2/6
8mfd 350V	2/6
10mfd 40V	1/6
8mfd 525V (miniature)	4/6
8mfd 525V	3/6

(Plus postage)

12-inch P.M. Speakers

Heavy duty 12in per-mag speaker by well-known manufacturer. 10T, CT, or 5000 Transformer **£2/17/6**
Postage: N.S.W., 5/6—Interstate, 7/6

CONDENSER SPECIAL

Boxes of 100 new mica paper and electrolytic condensers in values ranging from 50pf. mica to 5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500mfd/12v, 10mfd/40v, 8mfd/525v, 16mfd/350v electrolytics.

30/- PER 100 — POST EXTRA N.S.W. 2/6 INT. 3/6

NEW ENGLISH B.S.R. RECORD PLAYERS 3-SPEED

LIQUIDATION STOCK

These players, Model GU4A are fitted with turnover crystal pick-up. Finished in cream and brown. **SPECIAL PRICE**
£8/17/6 Plus Postage Packing N.S.W. 9/6 Int. 18/6
Plastic covered portable cabinets for above.
£4/15/- F.O.R.

NEW STROMBERG CARLSON SINGLE SPEED RECORD CHANGERS

With Crystal Pick-up
£4/19/- F.O.R.

I.F. TRANSFORMERS

Standard I.F. transformers square can (1⅜) 455K.C. permatuned **4/3**
(Plus postage)

MERCURY SWITCHES

The switch with 1000 uses **2/6** Postage 6d.

I.R.C. RESISTORS

100 I.R.C. carbon resistors, ½, 1 & 2 watt, in values 50 ohm to 5 meg. including many popular sizes, 3T, 15T, 20T, 25T, 50T, 100T, 250T, 500T, etc.
(Standard resistor color code supplied.)
Box of 100 **18/6**
(Plus 1/6 postage)

NEW VIBRATORS

6 volt A.W.A. gas-filled vibrators. Heavy duty synchronous.
NOW 7/6 or 70/- per doz.

HOOK-UP WIRE

(10—, 010)
Rubber-covered — **6/9** 100ft.
Rubber and glazed Cotton push back **10/-** 100ft.
Glass insulated **8/6** 100ft.
Postage extra

SAPPHIRE NEEDLES

Rothermel sapphire needles play 2000 recordings. Made in England. Each **2/9** or **25/-** dozen.

POTENTIOMETERS

Standard ½ or 1 meg. switch pots long spindle d/p switch	6/6
½ meg. or 2ST. ohms short spindle switch pots.	2/6
½ meg or 100T standard pots long spindle.	3/6
½ meg. or 100T short spindle	1/9
5 meg. high insulation.	5/-

All plus postage

Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087
479 PARRAMATTA ROAD, LEICHHARDT, N.S.W. PHONE LM3610

NEW VALVES

1H5 .. 9/6	6K8G .. 11/6	6F6 .. 9/6	AV11 .. 5/-
1Q5 .. 9/6	EK32 .. 15/-	807 .. 12/6	EZ82 .. 9/6
1T4 .. 9/6	6J8 .. 15/-	EL32 .. 9/6	117N7 .. 15/-
1R5 .. 15/-	6K7 .. 7/6	12A6 .. 12/6	4307A .. 10/-
1S5 .. 15/-	KTW62/6U7 .. 7/6	6J7 .. 8/6	5Y3GT .. 12/6
3S4 .. 15/-	EF8 .. 9/6	5U4 .. 12/6	12SR7 .. 3/6
3V4 .. 15/-	7C7 .. 3/6	6SN7 .. 10/6	1H6 .. 7/6
1K5 .. 2/6	7A6 .. 3/6	954 .. 5/6	1J6 .. 7/6
1L5 .. 9/6	78 .. 7/6	955 .. 5/6	1D8GT .. 10/-
1C7 .. 9/6	6J6 .. 12/6	VR150 .. 15/-	1D5 .. 9/6
6U7G .. 7/6	6AG5 .. 10/6	VR65A .. 2/6	9001 .. 5/-
6G8G .. 11/6	6B8 - Metal .. 12/6	EBC33 .. 9/6	81 .. 15/-
71A .. 7/6			

ALL VALVE PRICES PLUS POSTAGE

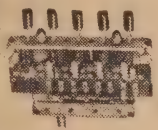
MIDGET CONDENSERS

Seven plate midget condenser, ceramic insulation, standard single hole mounting ¼in spindle 0-30pf. .. 5/6

NEW SWITCHES

Yaxley 3 x 3 SB .. 3/3
Oak 3 x 2 2B .. 4/6
Alpha DP/DT .. 3/3
Oak 1 x 2 SB .. 1/9
Oak 1 x 3 SB .. 2/-
Oak 4 x 2 SB .. 3/6
Post extra

PUSH-BUTTON SWITCHES 20/-



Five pole push-button switches .. ..
New control box fitted with above switch also 5 bezels with globes and multi contact key switch.
Post N.S.W. 2/-
Int. 3/-

GENERATORS

12 volt 500 watt tested in good order .. .. £3/10/- F.O.R.

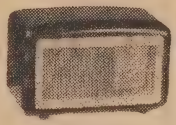
BUZZERS

Buzzer, variable note, works off 3 volt battery 7/6

NEW GRAMO-MOTORS

New H.M.V. spring gramo. motors, less turntable. Adaptable for many uses. 19/6. Postage N.S.W., 4/6; Interstate, 7/6.

Carbon microphone transformers. New, 4/6. Post extra.



POST AND PACKING
N.S.W 10/6
INT. 16/6

NEW ROLA EXTENSION SPEAKERS

Rola 6-9L Oval Speaker, mounted in attractive bakelite cabinet with matching metal grille and complete with volume control.

£3'12'6

METAL RECTIFIERS

90 volt 200m.a. metal rectifier, suitable for operating relays, etc., 9/6

THROAT MICROPHONES

New American throat mikes.
Per pair 3/6

SIGNAL LAMP GLOBES

Lucas signalling lamp globes, 10v. 6/- per doz.
PRE-FOCUS GLOBES
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FROM THE SERVICEMAN WHO TELLS

(Continued from Page 79)

is decision, since work on the new product must have commenced months ago, ut that does not detract from the fact hat the need has been recognised and teps taken to satisfy it.

Let us hope that other manufacturers ollow suit.

And now, to finish up, I cannot allow o pass unchallenged a statement which ppeared in the daily Press recently regarding 3-D television. Accompanied y a picture of a pretty girl wearing a air of special glasses, the par went on o explain that the model was looking t the first 3-D television system in the vorld, at a recent London trade display.

OUBLE PHOOEY!

Then came the choice bit. I quote: Developed from the same principle as VistaVision and Cinerama, three-dimenional television gives perfect clarity . . . tc., etc."

Phooey! In fact, double phooey!

For one thing, 3-D is by no means ew. It was demonstrated by Baird back n the days of 30-line transmissions on he broadcast band. So let's hope that ve hear no more about "first 3-D TV ystems".

More important, however, is the comarison between the 3-D system, as decribed, and VistaVision and Cinerama. he TV system described did appear to e a true 3-D system—hence the special glasses. VistaVision and Cinerama, on the other hand, are about as three-dimensional as a pancake that has been under a steam roller.

In spite of what has been subtly suggested in the publicity blurbs, and what the writers of them would like us to believe, neither of these systems can make any claim to being third-dimensional. They are large screens—just that and nothing more.

FREE VISION 3-D

Furthermore, it is unlikely that we will ever have anything better—either in motion pictures or TV. "Free vision" 3-D (3-D without glasses, viewing devices, or other restrictions) is still just as much a myth as perpetual motion—and about as likely to eventuate.

And what has all this to do with your Serviceman? Just this. I hate the idea of all the ballyhoo and patently erroneous statements formerly associated with the motion picture industry being foisted on the TV public. It's hard enough for the average non-technical person to make a wise decision as it is, without having to sort out the true from the false statements churned out by non-technical publicity types who haven't a clue what they're babbling about.

You see, there was a period in my life when I earned my daily bread alongside a pair of projectors.

HOW LIGHT AMPLIFIERS WORK

(Continued from page 11)

o in the amplifier of light, since the freuency of color of the output light enerated need have no direct relation o the frequency or color of the incident ght.

As a result, the light amplifier is charcterised by an input frequency charcteristic (photo-sensitivity spectral reponse) and an output frequency reponse (spectral emission of luminescence).

In the case of the amplifier of Fig. 1, ie decay characteristic is primarily dermined by the phosphor. The decay aracteristic of the light amplifier of ig. 3 is presently determined primarily y the photoconductor.

RANSFER CHARACTERISTIC

The transfer characteristic of the light nplifier of Fig. 1 is essentially linear. he transfer characteristic of the panel nplifier shown on Fig. 3 is non-linear. e., the gain is a function of the light put which is shown on Fig. 5.

In general, the brightness gain of a ght amplifier need not correspond to ower gain. However, if an amplifier of ght is defined as one wherein the color the output light is approximately the me as the color of the input light, the ightness gain does often correspond the power gain.

If the input and output colors are substantially different and there is a power gain, as in the case where the input is in the deep blue and the output is, say, green, it is more appropriate to call the device an amplifier-converter.

If the device merely converts invisible light such as ultra-violet or infra-red into visible light such as green without power gain, it merely acts as a converter. A simple example of a converter is a phosphor excited by ultra-violet light.

In conclusion, it should be pointed out that the panel amplifiers of light developed at RCA Laboratories have been made up to 12in square and having a thickness only slightly larger than the supporting glass plate. The resolution of this type of amplifier is, in general, limited by the thickness of the layers used.

GOOD RESOLUTION

In the case of the 12in panel built, the resolution was found to be over 500 television lines, and has been tested with a television picture input. The amplifier picture did not suffer in resolution or contrast range, but because of the transfer characteristic shown on Fig. 5, the "gamma" of the amplified picture was greater than that of the input picture.

Using the panel as a amplifier, a maximum power gain of about 20 was obtained.

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ANSWERS TO CORRESPONDENTS

J.H. (Largs Bay, SA) writes to congratulate us on the article on TV servicing equipment, but wants to know if the humble valve tester still has a place in the scheme of things. He also wants to know if our latest R/C bridge is suitable as it stands for TV work.

A. Thanks for the comments, J.H., and we will try to keep readers up to date on this subject. The valve tester is most certainly required for TV work and your latest model should prove invaluable. It was not mentioned because it was considered that this was something which most well equipped servicemen would already possess. The R/C Bridge would certainly be suitable for TV work and we can see no reason why it would need to be modified.

I.G. (Melb., Vic.) writes to say that while browsing through a series of articles dealing with what one has to do to obtain an amateur licence, he could not find any reference to the age limit set by the PMG.

A. Although this query has been raised on previous occasions on this page, we will answer it again for the benefit of new readers. The minimum age limit set by the PMG for an amateur licence is 16 years.

K.L. (Brisbane, Qld.) asks us whether it is feasible to use a 90 volt battery with the Loop Stick One, and what changes are required if it is.

A. It would be quite in order to use 90+ volts for the high tension supply in the "Loop Stick One". The main change would be the inclusion of a screen dropping resistor and a 0.1 mfd screen bypass, as the IT4 valve is designed to operate with a screen supply voltage of 67½ volts.

The value of dropping resistor would be about .05 meg and may have a half watt rating. In view of the increased high tension regeneration may increase and some adjustment to the reaction winding may be necessary.

R.S. (Rockdale, NSW) enquires regarding the use of a push-pull output transformer with a single ended output stage, half the primary being left unconnected.

A. Using half the primary winding gives only one quarter the impedance of the whole winding. The choice therefore depends on which value most closely approaches optimum load for the single valve. The unbalanced DC through the winding may also saturate the core and prejudice bass response. If the transformer can be dismantled easily, it would help matters to reassemble the laminations with a butt joint rather than interleaved, as is usual for push-pull. The transformer will work in any case; it is just a matter of getting the best from it.

T.R.M. (Bulimba, Q) submits some additional information on a circuit of a set we have filed for possible use in the "Reader Built It" section of the magazine. He also asks whether it would be feasible to connect up a power supply using two rectifiers and two power transformers on hand to give an increased current rating for the overall supply.

A. Many thanks for the additional data for your setup. We will file the information with your previous letter. If you do not wish to go to the expense of a larger transformer, it is quite a good idea to use the setup you have in mind. Two transformers rated at 385V a side, 80mA should give about twice the current rating (160mA) for this arrangement.

B.K.H. (Rose Park, S.A.) has recently modified an ancient set along the lines of the Basic Three and, although pleased with the overall results, is a little worried over the selectivity inasmuch as the two local stations tend to drown out the more distant ones.

A. Firstly it is essential that the regeneration is working correctly in this type of receiver to ensure good selectivity. You did not mention whether this part of the circuit was operating to your satisfaction and we advise you to check this point. If the regeneration is operating correctly in causing the set to oscillate and is smooth in control then it would seem that the limitations of this particular type of receiver have been reached. However, there is a simple trick sometimes helpful in cases such as yours. By reducing the length of your aerial, and thereby reducing the overall signal strength, strong signals can be confined to a portion of the dial. This may enable you to pick out other stations.

G.N. (Nedlands, WA) submits a circuit of an amplifier.

A. Thank you for your design, G.N. We are filing it with a view to possible inclusion in the "Reader Built It" section of the magazine in a future issue.

R.E.P. (Essendon, Melb.) is a regular reader of the magazine and offers some comment on some particular articles he would like to see published. He would also like some data on a valve type CV93.

A. Sorry, but we are unable to help you with information on the type of valve you mention other than that it is a triode put out by Mazda. We suggest you contact some of the valve manufacturers. Articles on tape recording have appeared from time to time in the magazine and a visit to your public library may enable you to locate some articles of interest. We feel that the serviceman correspondent is fairly down to earth with his articles which are set out so as to teach the beginner as well as help the radio shop serviceman.

Circuits that may be of interest to you are the IK5 One, Two and Three of June, July and August respectively, and the D Junior featured in the October, 1954, issue of R., TV & H. Reprints of these are available in the usual way through the query service.

C.S.H. (Malabar, NSW) suggests that we describe a constructional design for a television receiver over a nominal period of six months similar to presentation of the recent "1955 Little General".

A. Thanks for your letter, C.S.H. When components become available in large enough quantity to satisfy the demand of our readers we will probably feature a suitable design. And, taking all things into account, we will probably have to extend the constructional details over a period of time, as suggested in your letter.

T.E.W. (Canberra, NSW) would like to know whether English or other television sets could be used here in Australia without adaption to local channels and lines.

A. Many thanks for your kind remarks concerning the magazine, T.E.W. From time to time, in feature articles on TV, we have mentioned the difference in overseas systems compared with ours, but for the most part have not discussed the problem of adapting receivers. Television receivers designed for English standards would be entirely unsuitable for use here and, in most cases, there would be no future in attempting to adapt such receivers for the Australian standards.

L.C.G. (Yarraville, Vic.) writes to express his appreciation of our magazine and in particular "Argument" and "Serviceman" series. He enquires whether we have ever described a valve tester and points out how useful such an instrument would be. He also forwards a case for the Serviceman.

A. Many thanks for your comments, L.C.G., and we are glad to learn that you enjoy the magazine so much. We have often considered the possibility of describing a valve tester but have been deterred due to the difficulty of obtaining some of the special switches normally required. However, we have not abandoned the idea and may yet evolve a design suitable for home construction. We will pass your article on to the Serviceman for his possible comment in a future article.

W.K.J. (Perth, WA) would like to see another series of articles along the lines of the "Learn While You Build It" series which appeared a few years ago. He also would like some suggestions as to why his four valve set should "fade".

A. Thanks for the suggestion, W.K.J., and we will keep this idea in mind. In the meantime, the current presentation of the "Little General" for beginners may interest you. Fading can be a very difficult trouble to trace particularly if it is so easily cured. We assume the effect is not a true fade, i.e. a slow decrease in volume, but rather an abrupt change. If so, we would first suspect one of the by-pass capacitors, such as the IF screen by-pass or the AVC by-passes. Alternatively any dry joint can cause a similar effect, or it may be necessary to realign the chassis very carefully. Removing suspected capacitors, one at a time, and observing whether the effect is similar to the fault is one method of tackling the problem. Otherwise we can only suggest you enlist the aid of someone with a little more experience.

G.C. (Hunter's Hill, NSW) sends a series of questions concerning the use of disposals gear as an amateur station.

A. To answer your last questions first. No it is not possible for anyone with practically no knowledge of radio to set up a station and the authorities are very strict in seeing that only qualified persons are allowed to operate such equipment. A "ham" licence is only granted to those persons who are able to pass an examination set by the PMG's department, covering basic radio principles and morse code (the code is not required for operation on 144 Mc and above). By the time your studies have reached the stage where you can tackle this examination you will be in a better position to undertake to modify disposals equipment for your particular requirements. We have never described how to modify any of these for amateur operation.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

THE 1956 KARSET

(Continued from page 73)

The wiring is fairly straightforward d is done partly in hookup wire, for e filament, B plus, AVC lines, etc.— d partly in bare tinned copper wire, r direct grid and plate leads between ils and sockets.

In the rear corner, behind the second , are two five terminal tag strips. ney serve to terminate the incoming e-way cable and to support the various put filter components. These are the RF choke, two LT by-passes (.1 fd), a 1000 pf LT ceramic bypass, and 1000 pf HT ceramic by-pass.

All these by-passes are earthed to e mounting lug of the tag strip. If ere is any doubt about the effectiveness of this earth it should be bonded the adjacent soldered earth point on e 6BA6 socket.

Audio leads to the pot. are of shielded okup wire, encased in 5mm plastic ping. The shielding is most conniently earthed at the 6AV6 socket. ne earth lug of the pot. is connected plain hookup wire to an earth lug ove the chassis at this same point.

ARTH RETURNS

Other earth returns, likely to be crial, are as follows: To the earth point the 6BA6 RF socket; the cathode, ppressor, and shield of the 6BA6, e .04 mfd AVC by-pass from the rial coil, and the .1 mfd screen byss. We also run an insulated lead om the appropriate gang wiper (beeen the first and second sections) to is point.

To the earth point at the 6BE6 socket take the shield of the 6BE6, the cillator grid resistor and its associated pass, the second gang wiper, the earth n of the oscillator coil and the .04 fd AVC by-pass from the RF coil.

(To be perfectly logical, the gang ould be earthed only at these points, ing insulated at all other points. While t impossible, it would obviously comcate the construction and we felt that s was hardly justified. As it turned t, our assumption appears to be tified.)

OT CRITICAL

To the earth point of the 6BA6 socket return the 6BA6 cathode, suppres- , and shield, plus the .04 mfd AVC pass from the first IF.

The remaining returns are probably critical, since the signal level from e on would normally be strong enough drown any hash impulses. However, earth lugs provide logical points to urn the various earth connections for h valve.

The only other items likely to cause uble are the two 1 meg AVC resis- s connecting to the diode pin. These uld be mounted as close to this pin possible, this part of the circuit be- "hot" at RF. The other ends of the stors are effectively earthed and not tical.

So far we have spoken of the power ply in general terms only. A more tailed description will have to wait unnext month, when we hope to also uss installation problems and conver- n for 12-volt operation.

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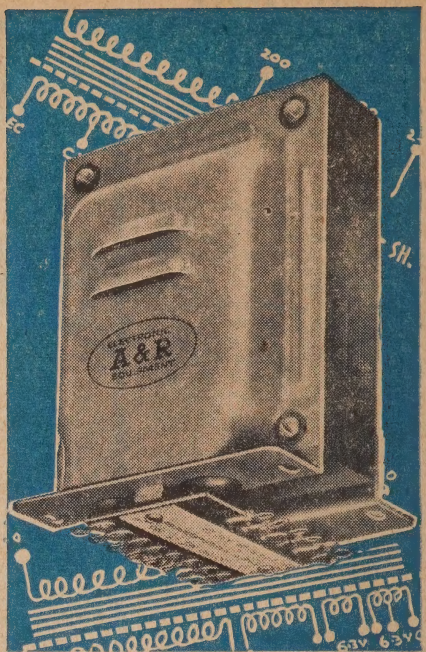

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1764	"	" " "	325—CT—325	
1765	"	" " "	385—CT—385	All in this Section
1766	125	" " "	285—CT—285	
1767	"	" " "	300—CT—300	5v—2A; 2 x 6.3v—2A.
1768	"	" " "	325—CT—325	
1769	"	" " "	350—CT—350	
1770	"	" " "	385—CT—385	
1771	150	200—230—240	285—CT—285	5v—3A; 6.3v—2A; 6.3v—CT—2A.
1772	"	" " "	325—CT—325	ditto
1773	"	" " "	350—CT—350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1774	"	" " "	350—CT—350	5v—3A; 6.3v—CT—3A; 2.5v—5A.
1775	"	" " "	385—CT—385	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1776	175	200—230—240	285—CT—285	
1777	"	" " "	325—CT—325	
1778	"	" " "	350—CT—350	All in this Section
1779	"	" " "	385—CT—385	
1780	200	" " "	350—CT—350	5v—3A; 6.3v—3A; 6.3v—CT—3A.
1781	200	" " "	400—CT—400	
1782	200	" " "	450—CT—450	
1400	250	200—220—230—240	565, 500, 425 A side	2 x 6.3v—3A; 2 x 2.5v—3A; 5v—3A.
1371	300	" " " "	1000, 850, 750, 600, 500 A side	— — —

Types 1763 to 1782 Vertical Mountings; Type 1400 Horizontal; Type 1371 Vertical with Top Term Board.

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A COURSE IN TELEVISION

(Continued on page 55)

is used to check that the sound carrier will ride at the proper point on the response curve."

As mentioned earlier, the foregoing instructions are typical only but do indicate the general approach which manufacturers have to adopt to align such channels.

As in the case of stagger-tuned systems, uninformed fiddling with IF slugs can only lead to hopeless confusion in the end result.

OTHER SYSTEMS

While over-coupled transformers are the most common approach, various other bandpass systems have been used, which readers will recognise from other associations.

Instead of the plate and grid windings being inductively coupled, one to the other, they may be physically quite separate. The two low potential ends are then brought together and taken to ground (or its equivalent) through a common capacitor. It is, in fact, the same basic circuit as employed in conventional band-pass AM tuners.

Alternatively, the two windings may return to ground through a common inductor.

Capacitive "top" coupling is also possible or yet another capacitive divider scheme, where a small capacitance is made common to both tuned circuits.

Any of these schemes may be used exclusively in an IF channel or in combination with other schemes which the designer happens to fancy. Even triple-tuned transformers have been seen and resonant feedback schemes aimed at flattening a normally peaked curve.

Such schemes are sufficiently rare, however, not to warrant lengthy discussion here.

TRAP CIRCUITS

Trap circuits may be included or omitted, according to the ideas of the designer and the selling price bracket which the particular receiver has to meet.

The trap circuits illustrated earlier are parallel resonant circuits lightly coupled to plate circuits throughout the IF channel. This is not by any means a universal practice.

Such traps may be coupled inductively to the plate loading coil, thereby saving a coupling capacitor, but throwing onus on the component manufacturer to provide the requisite small amount of inductive coupling.

Straight series absorption circuits are also used on occasions or even parallel circuits which present a high impedance in the signal path at their resonant frequency. Main difficulty with these two types systems is their tendency to increase capacitance to earth and lower the L/C ratio of the coupling circuit.

Finally, trap circuits are sometimes found in the cathode returns of the IF amplifier valves, where they can introduce a sharply-defined trough, due to their high impedance at resonance and consequent cathode circuit degeneration.

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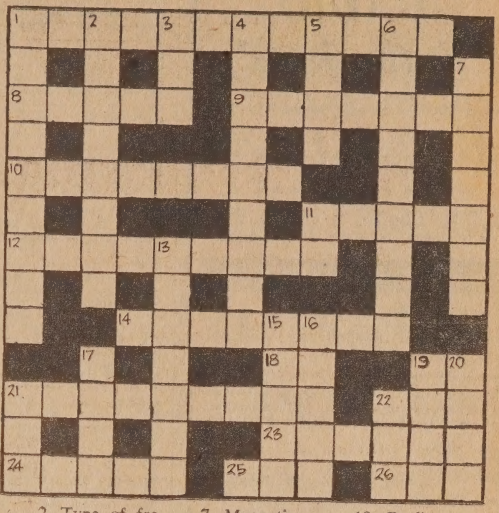

ACROSS

1. Valve output system (2 words).
8. Proportion.
9. Framework of equipment.
10. Another term for autoheterodyne.
11. An explosion.
12. Person of no importance.
14. Part of a multi-wire antenna.
18. To depart.
19. Full frequency (abbrev.)
21. Series of cells (pl.)
22. French coin.
23. Unit of attenuation (pl.)
24. Collection of single things.
25. Limited (abbrev.).
26. Golfers requisite.

DOWN

1. Reciprocal of reluctance.
2. Type of frequency changer.
3. The self.
4. Something that arouses
5. Crustacean.
6. Used to isolate a conductor.
7. Magnetic system in equilibrium
11. Beside.
13. Pincers.
15. Authorised person.
16. Well supplied with doses of medicine.
17. Sealed box (French).
19. Prefix meaning before.
20. Safety device against excess current.
21. British Thermal Unit (abbrev.).
22. Number of things used together.

Solution and further crossword next month

As mentioned earlier, the valves which are normally used for IF amplification are characterised by very high transconductance, in order to ensure good stage gain under the deliberately broadband conditions. The 6BX6, for example, has a transconductance of about 7000, the exact figure depending on operating conditions.

To achieve such a figure and to maintain it within acceptable tolerance requires extreme precision in valve manufacture. At the same time, internal capacitance figures must be kept as low as possible and as constant as possible to facilitate tuned circuit design.

Operating conditions must be chosen carefully to achieve the required gain but special factors have to be considered. An example is the use of an unbypassed cathode resistor, mentioned earlier, to combat variations in apparent input capacitance.

Automatic gain control voltages must be applied discreetly if they are to be effective on the one hand, yet not lead to envelope distortion on the other, causing picture quality to suffer. Some of these questions will be discussed later in the series under separate subject headings.

Another section of the IF system—that dealing with the inter-carrier sound—will also be discussed separately.

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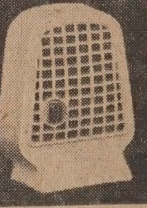

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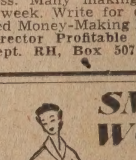

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